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THE VARIATIONS OF REAL WAGES AND PROFIT MARGINS

IN RELATION TO THE TRADE CYCLE

A THESIS FOR THE PH.D. (ECON.) DEGREE
AT THE UNIVERSITY OF LONDON

BY

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PREFACE

THIS short study is the modest result of my work at the London School of Economics as a research student and has been accepted by the University of London as a thesis in partial fulfilment of the requirements for the Ph.D. (Econ.) degree.

In writing this book, I am particularly indebted to Professor Hayek, to whom I owe not only constant supervision and encouragement but also the suggestion of this subject as one worthy of further investigation. In a more fundamental sense, I am also indebted to him, together with my other teachers at the London School of Economics, for my original training in handling the tools of economic analysis. For the blunders, which I may have committed in this study, however, I alone am responsible.

I wish also to take this opportunity to express my gratitude to the British Council for a scholarship, without which I would not have been able to finish my studies. My thanks are also due to the editors of the *Economic Journal* for their permission to let me reprint, with only slight alterations, an article which I contributed to that journal as a chapter in this book.

S.C.T.

TO THE MEMORY
OF MY FATHER

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THE VARIATIONS OF REAL WAGES AND PROFIT MARGINS IN RELATION TO THE TRADE CYCLE

INTRODUCTION

THE recent renewal of interest with regard to the relative movements of real wages and business activity is largely induced by the controversies over the recent theories of two eminent economists, viz. Lord Keynes and Professor Hayek. The former has put forward an apparently paradoxical proposition about the relationship between changes in money and real wages in his celebrated book, *The General Theory of Employment, Interest and Money.* The latter, in a recent version of his trade cycle theory, made the level of real wages a key factor determining the investment demand through its influence on the capital intensity of production.[1] Both theories have produced considerable crops of controversy and the movement of real wages during the trade cycles, so complacently neglected by the theoretical economists in the past, has become the object of attention.

On page 10 of his well-known book, Lord Keynes made the remark that—

"It would be interesting to see the results of a statistical enquiry into the actual relationship between changes in money wages and changes in real wages. In the case of a change peculiar to a particular industry one would expect the change in real wages to be in the same direction as the change in money wages. But in the case of changes in the general level of wages, it will be found, I think, that the change in real wages associated with a change in money wages, so far from being usually in the same direction, is almost always in the opposite direction. . . . This is because, in the short period, falling money wages and rising real wages are each, for independent reasons, likely to accompany decreasing employment; labour being readier to accept wage-cuts when employment is falling off, yet real wages inevitably rising in the same circumstances on account of the increasing marginal return to a given capital equipment when output is diminished."

That rising money wages should be associated with falling real wages seems to have struck some people as profoundly paradoxical. But in fact his proposition, as is pointed out by himself in a later

[1] F. A. Hayek, *Profits, Interest and Investment,* first essay; and also "The Ricardo Effect," *Economica,* May, 1942.

article[1], is based on his acceptance, without taking care to check the fact for himself, of a popular belief which has been unquestioningly held by a large number of economists up to very recent years; viz. the fact that in the short period the real wages tend to fall as the level of employment increases, or, to put it in a different form, that the rises of money wages always tend to lag behind the rises of prices in a period of rising activities. His argument in the passage quoted above can be analysed into three steps. First, assuming rightly or wrongly that all prices are perfectly flexible and are always equal to the respective marginal costs, as they should be at equilibrium under perfect competition, an autonomous all-round increase of money wages in a close system will simply push up all the prices by the same proportion at any given level of output. For given the level of output in every industry, the marginal costs of production in terms of real units in every industry must remain the same. A general rise of money wages will only raise the marginal money costs in every industry by the same proportion. Therefore, according to Keynes, so long as the level of output does not change, the real wages of labour is given, whatever the level of money wages. We are not concerned here with the more dubious contention that at any moment an autonomous cut or rise of money wages in general has no effect on employment as well as real wages. That was never very strongly contended by Keynes himself, for he was expressly of the opinion that changes in money wages have very complex reactions on the level of output which may be in either direction according to circumstances, depending particularly on the entrepreneur's expectations as to further changes in money wages in the future, and about which it is very difficult to generalize.[2] What is relevant here for his argument about the relative movements of real wages and employment is merely that in a closed system at any given level of employment the level of real wage is independent of the money wage rates. This follows more or less from his assumption that prices are perfectly flexible and are always equated to marginal costs without any appreciable time-lag.

The second step of his argument is that in the short period during which the amount of capital equipment and the state of technique can be roughly taken as given, real wages must decline as employment and output increase, because of the diminishing marginal physical productivity of labour which must be operating throughout the relevant range of operation in every industry under the assumption of perfect competition.

[1] "Relative Movements of Real Wages and Output," *Economic Journal*, March, 1939, p. 34.

[2] Cf. *The General Theory of Employment, Interest and Money*, Chap. XIX, "Changes in Money Wages."

Thirdly it is assumed that rises in money wage rates generally take place in time of rising employment, because labourers are then in a stronger bargaining position in pressing for higher wages and entrepreneurs are more willing to consent. It follows therefore from these three premises that rising money wage rates will be associated with falling real wage rates. Not that the one causes the other, but that they are both likely to accompany increasing employment.

This assertion that real and money wage rates generally move in opposite directions has aroused a challenge from Mr. J. T. Dunlop who put it to a statistical test with respect to British experiences.[1] His investigation into the British statistics appears to show that increases in money wage rates have usually been associated with increased real wage rates, while decreases in money wage rates have equally often been associated with a rise or fall in real wage rates.[2] And, what is more important, it is also shown that real wage rates more often than not rose in the upswing and fell in the downswing. These results at once cast serious doubt on the widely held conventional notion with regard to the relative movements of real wages and employment, which underlies Lord Keynes' argument.

Earlier in 1927 Professor Pigou has also pointed out in his *Industrial Fluctuations* that "the upper halves of trade cycles have, on the whole, been associated with higher rates of real wages than the lower halves. If secular trend were eliminated from the wage curve this would appear still more plainly."[3] His conclusion was drawn from a statistical comparison of the index of real wage rates with the percentage of unemployment from 1850 to 1910. His conclusion with regard to the period after the first World War was, however, exactly contrary. In the same year in an article in the *Economic Journal* entitled "Wage Policy and Unemployment" he remarked—

"For a considerable period before the war, there was a distinct negative correlation between rates of real wages and quantity of unemployment: on the whole rates of real wages were higher when employment was good, lower when it was bad. Since the war, however, there has been a strong positive correlation between rates of real wages and unemployment."[4] Subsequently he seems to have reverted completely to the more conventional notion, and in his "Theory of Unemployment" published in 1933, he writes—

"In general, the translation of inertia from real wage-rates to money wage-rates causes real rates to move in a manner not compensatory, but complementary, to movements in real demand function.

[1] *Vide* John T. Dunlop, "The Movement of Real and Money Wage Rates," *Economic Journal*, September, 1938.
[2] Dunlop, *loc. cit.*, p. 421.
[3] A. C. Pigou, *Industrial Fluctuations*, 1st ed., p. 217.
[4] A. C. Pigou, "Wage Policy and Unemployment," *Economic Journal*, 1927.

Real wage-rates not merely fail to fall when the real demand for labour is falling, but actually rise; and in like manner, when the real demand for labour is expanding, real wage-rates fall."[1]

Furthermore, a hitherto much neglected statistical phenomenon, to which Mr. Kalecki has recently drawn our attention,[2] viz. that the relative share of labour in the national income both in Great Britain and in the United States is remarkably stable irrespectively of the level of output as a whole and the phase of the trade cycle, is forcing more doubt on the traditional presumption. The remarkable stability of the proportion of national dividend accruing to labour, as shown by the available national income statistics in these two countries, appears to be difficult to reconcile to the proposition that real wages must fall or prices must rise relatively to wages as the trade activity increases. Mr. Kalecki himself computed an index of real wages for the United States from 1919 to 1935 by dividing a combined index of hourly wages in manufacturing, building, railroad, and agriculture, and divided it by an index of the cost of living.[3] After the elimination of trend, the fluctuations of the index of real wages are small and no clear negative or positive correlation with those of output can be observed.

It comes to be suspected, therefore, that the hitherto little disputed notion about the relative movements of real wages and employment, so widely held by generations of economists, might not have had sufficient factual foundation. The implication of this, as Mr. Kalecki has expounded in his book, would be profound in the spheres of the theory of price-determination and the theory of distribution.[4] It will also have far-reaching effect in the field of trade cycle theory, particularly with regard to the new theory of Professor Hayek. In his recent essay on Profits, Interest and Investment, he explains the break of the boom as being brought about by the successive falls of the level of real wages during the upswing, which he takes for granted.[5] The fall in real wages, according to him, has the effect of changing the relative profitability of the different methods of production in favour of the shorter or more direct ones, and thus causing a general switching over from the more capitalistic methods of production to less capitalistic ones—a process which he christens the Ricardo Effect.[6] And this process will go on during the upswing so long as real wages continue to decline, until the investment demand for the

[1] *Op. cit.*, p. 296.
[2] M. Kalecki, *Essays in the Theory of Economic Fluctuations*, first essay.
[3] M. Kalecki, *op. cit.*, pp. 82–83.
[4] M. Kalecki, *op. cit.*, first essay.
[5] *Profits, Interest and Investment*, p. 11.
[6] *Ibid.*, first essay, esp. pp. 8–10. Also "The Ricardo Effect," *Economica*, May, 1942.

widening of capital structure in order to meet the expanding effective demand for current output is offset by the successive reduction in capital required per unit of output, and total investment demand—and consequently total employment—is finally turned to decline.[1] And conversely, the supposed high level of real wages at the bottom of the slump is alleged to be an important factor in bringing about the revival of investment.[2] If, however, the actual behaviour of real wages should prove to be different from what it is assumed to be, the implication would obviously be of great significance.

The results of Professor Pigou's earlier inquiry and Messrs. Dunlop and Kalecki's investigations, however, cannot be regarded as conclusive for our purpose. For one thing, both their indices of real wage rates were obtained by dividing the index for money wages with the index for cost of living.[3] It is therefore a sort of index for real wages in terms of wage-goods on which wage-earners regularly spend their wages. Now for the purpose of considering the real earnings and welfare of the wage-earners, wages in terms of wage-goods is no doubt the relevant meaning for the term real wages, and their indices are the appropriate measurement for the variations of the rate of real wages in this sense. For the present context, however, real wage rate in a different meaning, viz. in the sense of labour's recompense in terms of its own composite product, is more appropriate. This is so for the following reasons.

First, the conventional presumption of a negative association between the rate of real wages and employment either is based on a loose generalization that money wages are generally more rigid than prices in general, so that in times of rising activities wages tend to lag behind the rise of prices, or, like the argument of Lord Keynes, is based on the assumption of rising marginal cost curves in wage units in most industries. It is therefore concerned primarily with the wage-price relationship for industry as a whole instead of with the relation between money wages and the prices of the products of a particular section of the industry such as the wage-goods industry. It applies to the behaviour of real wages in terms of wage-goods only in so far as the prices of wage-goods move in the same way as the prices of current output as a whole.[4]

Secondly, the level of real wages in Professor Hayek's theory is meant to reflect the cost of labour to the entrepreneur concerned and

[1] *Ibid.*, first essay, esp. §§ 6–8, pp. 18–29.

[2] *Ibid.*, pp. 39–40.

[3] Mr. Kalecki used the index of the cost of living on the ground that the index of prices of finished goods does not greatly deviate from that of the cost of living, which is open to question.

[4] Cf. Keynes, "Relative Movements of Real Wages and Output," *Economic Journal*, March, 1939, p. 43.

the margin of profit in production. However, for the entrepreneurs who demand and employ labour forces, the relation between money wages and the price of wage-goods or the cost of living does not directly enter into their cost calculation, unless wage-goods happen to be the products of their own firms. What is relevant to their cost and profit considerations is the relation between money wages and the prices of the products they produce; for, *ceteris paribus*, that determines directly the proportion of the proceeds from the produce, which must be paid out to labour as wages, and also the profit margin. It is therefore the rate of real wages in terms of labour's own products that is relevant for Professor Hayek's trade cycle theory. In his later article, "The Ricardo Effect," Professor Hayek has explicitly pointed this out as follows—[1]

". . . it must be pointed out that, although the phrase 'real wages' is sometimes used in this connection—i.e. in the available statistical information—the relation between wages and product prices with which we are concerned has no close connection with 'real wages' in the sense in which this term is commonly used. While in most contexts when real wages are discussed what is meant is the relation between wages as received by the worker and the prices of the commodities on which he spends these wages, we are concerned with the cost of labour to the entrepreneur and their relation to the prices of the products he produces."[2]

We shall therefore measure the movement of the rate of real wages by the quotient between the index for money wage rates and the index of the prices of current products in general, instead of measuring it by the quotient between the indices for money wage rates and cost of living. In the following study, we shall first attempt to throw some light on such questions as whether there is any definite *a priori* reason to expect the rate of real wages to correlate with the variations of employment and output one way or the other. Then we shall observe what its behaviour actually is during the business fluctuations. Finally we shall review Professor Hayek's theory in the light of our factual finding and submit it to a statistical test.

[1] *Loc. cit.*, p. 150.

[2] Professor Hayek has pointed out some further difficulties in the measurement of "real wages," which we shall discuss later on. (*Vide infra*, Chap. VI.)

CHAPTER I

THEORIES OF THE RELATIVE MOVEMENTS OF REAL WAGES AND BUSINESS ACTIVITIES

THE question of the influence on real wages of periods of boom and depression has a long history. It is perhaps as old as the discussion on the changes of the price-level. Without going farther back in the history of economic thought, it may be pointed out that this question was already frequently referred to even during the Bullionist controversies of the early nineteenth century. It was a point of common agreement that rising prices due to the expansion of note-issue would injure those people whose incomes would not rise readily, including the wage-earners, and thus impose a forced levy upon them, although whether this was really beneficial to trade and production was still a matter of controversy. On the other hand, it was also recognized that falling prices are likely to be a burden on industry because wages and rent do not fall readily. Since then, that the real wages tend to fall during periods of expansion and rise during periods of contraction seems to be the prevalent opinion among the economists until recently. There were exceptions of course; notably Foxwell, who, advocating an expansionist policy by means of bimetallism, pointed out in support that real wages were generally higher in periods of rising prices;[1] and Professor Pigou whose statistical investigation for the period 1850–1910, as we have already mentioned above, led him to a conclusion contrary to the conventional notion;[2] and Professor Cassel, who took an entirely agnostic view with regard to this question.[3] It is not our intention to go into the detailed history of the development of the views concerning the relative movements of prices and wages during the fluctuations of trade. Suffice it to point out that the arguments regarding the relative movements of prices and wages, or, in other

[1] H. S. Foxwell, *The Monetary Situation*, 1895, London, p. 40. "No doubt there has been a general increase in the real wages of labour during the fall of prices since 1873, though the movement has not been so rapid as it was during the rising prices of 1850–1873." Foxwell appears to have thought that real wages and the relative share of labour depend entirely on "the bargaining power and the intelligence of the wage-receivers," and that real wages would rise when production expands, because "English trade-unionists have no doubt whatever that if profit be made, they will soon get their fair share of it." (*Ibid.*, p. 40.)

[2] *Vide supra*, p. 3, and Pigou, *Industrial Fluctuations*, 1st ed., p. 217.

[3] G. Cassel, *Theory of Social Economy*, Vol. II, 2nd ed., pp. 609–610: "The question whether real wages do or do not rise during a trade boom has often been discussed. We cannot give a definite answer to this question, because the issue depends upon which of the tendencies at work get the upper hand. With the aid of statistics we can give many examples of every conceivable relationship between the increase and decrease in wages on the one hand, and the rise and fall in prices on the other."

words, the movements of real wages, generally fall into two broad types.

The first type of explanation for changes in real wages accounts for the fall of real wages during the boom by the fact that money wage rates are generally rather sticky and tend therefore to lag behind the rise of prices. It is simply taken for granted that during periods of boom the price-level would rise, leaving the prices of factors of production lagging behind. To the adherents of this type of explanation, the price-level is something determined entirely by monetary factors, and it is axiomatic that prices should rise in periods of monetary expansion and fall in periods of monetary contraction. Perhaps most of the economists who reasoned in this way were also adherents to the orthodox Law of Markets as formulated by J. B. Say and James Mill. To them the total output is determined largely by the community's capacity to produce. The rising monetary demand due to monetary expansion has no effect on aggregate output, though it is admitted that monetary expansion may affect the composition of products and impose a forced accumulation of capital. Output being regarded as more or less constant in the short period, the effect of the expanding monetary demand during the recovery and prosperity must be to drive up continuously the prices of the products. Against the rise of prices, wages must run a losing race, because of the fact that the demand for factors is derived from the demand for the products and consequently rises only after the prices of the products, and because of the institutional rigidity of wages.

It is now, however, generally recognized that during the trade cycles, output and employment usually fluctuate over a wide range. To analyse the relative movement of prices to wages, we must take into consideration the effect upon prices of the expansion of output during the boom and the contraction during the recession. Thus when recovery begins after the bottom of depression has been passed, the immediate impact of the increasing monetary demand might indeed be to raise the prices temporarily of products, which are for the moment in constant supply, relatively to wages and marginal costs. But the disequilibrium between prices and marginal costs will stimulate the entrepreneurs to take up the slacks in productive capacity and employment, and consequently the output will expand in response to the increasing demand. If the expansion of output is taken into consideration, the prices of products must be regarded as depending also on the shape of the short period supply functions for additional output and the relative speeds of the expansion of demand and that of output. Even if it is granted that when output is continuously stimulated to expand the prices might be constantly in disequilibrium with the marginal costs, provided that the short period

supply curves in most industries are sufficiently downward sloping, it is possible that prices might fall relatively to wages as output expands in response to the increasing monetary demand. This possibility was recognized as early as 1650 by William Potter, who argued in his book, *The Key of Wealth*, that if men spend more money, the sales of manufacturers will increase proportionately. If they sell five times as much in money value, they will produce five times as much, and even more in physical quantities, since they can afford to charge lower prices on the greater volume of sales.[1]

Thus the explanation that real wages fall during the boom because the money wage rates, being relatively sticky, tend to lag behind the rise of prices cannot be regarded as adequate. To say that the rise of money wages lags behind the rise of prices is simply another way of describing the fall of real wages; whereas the very thing to be explained is why prices should rise ahead of wages in spite of the alleged stickiness of money wage rates.

It is, therefore, surprising to find that an economist of the calibre of Marshall should, as pointed out by Lord Keynes, interpret the fall of real wages in booms and their rise in depressions merely by alleging that in the short period wages are stickier than prices. His view on this question was first expressed in his preliminary memorandum for the Gold and Silver Commission, 1887, where he wrote—

"During a slow and gradual fall of prices a powerful friction tends to prevent money wages from falling as fast as prices; and this tends almost imperceptibly to establish a higher standard of living among the working classes and to diminish the inequalities of wealth."[2] Subsequently he further confirmed his view in his evidence before the Indian Currency Committee, 1899. When asked "What do you take to be the immediate effect of a change in prices?" he remarked—

"A fall in the value of currency lowers all dues enforced by contract or custom . . . but employees cannot, as a rule, foresee (the changes in the purchasing power of money); and they have less power to act on their knowledge. The consequence is that a rise of wages is seldom or never as fast as that of prices when the cause of the rise is an increase of the currency, that is not accompanied by an increased command over nature."[3] His final conclusion was crystallized in a passage in the *Principles*—[4]

(When prices rise, the employers) "will therefore be more able and willing to pay the high wages; and wages will tend upwards. But experience shows that (whether they are governed by sliding

[1] *The Key of Wealth*, 1650, pp. 1–20. Also see Viner, *Studies in the Theory of International Trade*, pp. 37–38.
[2] *Official Papers by Alfred Marshall*, p. 19.
[3] *Official Papers*, p. 286.
[4] *Principles of Economics*, 8th ed., Book VI, Chap. VIII., § 6, p. 620.

scales or not) they seldom rise as much in proportion as prices; and therefore they do not rise nearly as much in proportion as profits." Again, in a different place (Book VI, Chap. V, § 6), he insisted that the demand for labour being derived from the demand for those things which it is used in making, "in these relatively short periods fluctuations in wages follow, and do not precede, fluctuations in the selling prices of the goods produced."

The effect of the induced fluctuations in output upon real wages was, however, nowhere considered. This neglect was probably due to the fact that Marshall was still much under the influence of the classical Say's *Law of Markets*, which asserts that aggregate production is determined largely by the available resources and that increase in the aggregate money demand has no effect on the total output. Thus fluctuations in effective monetary demand merely result in fluctuations of the price-level, and the tendency for money wage rates to be rather rigid and thus to lag behind the rise of prices both in time and in amplitude, as it is alleged, adequately explain the fall of real wages during the booms and the rise of real wages during the depression.

This type of explanation has been widely accepted by the economists in the past generations. It is usually treated as an empirical generalization, with no further attempt to support it with theoretical argument than to say that money wages tend to be sticky because of the force of custom, the lack of bargaining power among labour, the inertia of collective bargaining, etc. When it is found that the conventional notion about the movements of real wages does not seem to tally well with recent experience, particularly in the United States, economists who habitually think in terms of relative rigidity would simply turn about and say that now it is the prices that have become stickier than money wages.

Such change of attitude can best be seen in the case of Professor Taussig. In the early editions (first to third editions) of his *Principles of Economics*, it was confidently stated—[1]

"Periods of rising prices are, in fact, commonly periods of prosperity. . . . The chief explanation of the optimism and activity which business men in general show in times of rising prices is found in the relation which they as a class hold to the labourers as a class. At bottom their main operation is to hire labourers; and they hire labourers to advantage at such times, because the prices of commodities go up faster than money wages.

"That wages go up more slowly than prices is one of the best-attested facts in economic history. . . . It is due mainly to the force of custom, which is especially strong as to wages; and it is strengthened

[1] Chap. XXII, Sect. 5, pp. 297–8, 3rd ed.

often by the lack of bargaining power among labourers. It is connected with many peculiarities in the dealings between employers and employees, and especially with the position of the employer as feeling the brunt of any industrial change. Of the fact there can be no question; when prices rise, the wages of hired workers do not rise as fast.

"Conversely, the business class as a whole commonly loses in periods of falling prices. Then, since the same forces tend to keep wages stable, a fall in prices brings loss."

Here, as with Marshall, periods of prosperity are simply identified with periods of rising prices and the effects of rising prices on profits and real wages is explained merely by the stickiness of money wages.

In the latest edition (the fourth edition published 1939), however, there was a radical change of attitude. The statement that "that wages go up in times of rising price-level more slowly than prices of goods is one of the best-attested facts of economic history . . ." is still there.[1] But the qualification has now been added—

"All these remarks about changes in wages apply more to earlier times—say to the close of the nineteenth century—than to later. In the twentieth century the situation is changed. For various reasons wages have moved more than in accord with prices in times of rise, less so in times of fall. Labour organizations have become stronger, more alert to take advantage of favourable conditions, better able to resist the effect of depression. For one reason or another, the stickiness of wages has become less; markedly less in England as regards periods of falling prices, and less in the United States when prices are rising."[2]

Now it is clear that whether it is to explain that real wages fall during periods of prosperity, or that they rise, it is not sufficient to account for the behaviour of real wages merely by the relative stickiness or flexibility of wages and prices. These are the very things to be explained. For wages and prices are not determined entirely independently of each other. Prices, particularly under the condition of perfect competition, which is the working assumption of the traditional economists, must be connected in some way with the marginal costs of production, and consequently with the rate of wages, which, for a closed system as a whole, are the chief element of prime costs. As we have seen above, unless it is assumed that the total output becomes more or less invariable, as under the condition of full employment where the marginal cost curves in most industries become practically vertical, it is not adequate to explain the fall of real wages merely by the lag of money wages. When there is ample possibility for output to vary in response to changes in aggregate monetary demand, the cost functions in various industries and the relationships between

[1] Chap. XX, Sect. 8, pp. 276–7, 4th ed.
[2] *Ibid.*, p. 278, 4th ed.

costs and prices must be analysed. It may, indeed, be argued that even when there is possibility for output to expand in the short period, the impact of increased aggregate monetary demand would still in the first instance be to raise the prices relatively to costs. For under the assumption of atomistic perfect competition, which used to be taken as the typical condition for the industry as a whole, the only indication for the individual entrepreneurs to expand their output is a rise of the market prices of their products relatively to their marginal costs. For each individual producer is confronted with a horizontal demand curve. A rise of demand must imply an upward shift of his individual demand curve, so that there occurs a gap between the price and the marginal cost at the original output. During the recovery, when the aggregate demand is continuously expanding and output is continuously stimulated to increase, prices might be persistently out of equilibrium with—i.e. higher than—marginal costs. (Conversely when output is continuously contracting during the recession, prices might be consistently lower than marginal costs.) This, however, is not by itself a sufficient reason why real wages should fall or why prices should rise ahead of wages during periods of prosperity, for such tendency for disequilibrium to persist might easily be offset, should the supply curve for output of the industry as a whole be sufficiently downward sloping. Therefore an adequate explanation of the relative movements of prices and wages during the business fluctuations must be based on an analysis of the cost functions in various industries and the relationships between costs and prices.

The second type of explanation of the movements of real wages is based on such analysis of the supply functions in the various industries. This can again be divided into two different sub-types according to the methods of approach. The first is based on the marginal productivity theory of distribution and attempts to define the movements of real wage rates by means of a sort of aggregate demand function for labour in real terms. It is assumed that the entrepreneurs are always striving to maximize their profits by balancing their marginal revenues to marginal costs. Under perfect competition, which economists used to regard as representative of the industry as a whole, the marginal revenue to each individual producer of a slight expansion of production is always equated to the value of the incremental products and the marginal cost is always the value of the additional factors of production required. The maximization of profit therefore requires that the quantity of labour demanded by each entrepreneur should be such that the difference made to the total physical output by the marginal unit of labour with the co-operation of the appropriate increases of other prime factors must

approximate to the real wage of labour in terms of the product concerned plus the cost of the increments of other prime factors also in terms of the product concerned. In other words, each entrepreneur will demand labour up to a point where the marginal net physical product of labour equals the wage of labour in terms of the product of the labour concerned—i.e. the product-wage. The assumption of perfect competition, however, also necessitates that the marginal net physical product of labour must be falling for every individual firm over the whole relevant range of output and employment. For the stability condition of the equilibrium of the firm requires that the marginal revenue curve shall lie above the marginal cost curve of each firm to the left of the point of intersection between them. Since, under perfect competition, the marginal revenue curve of each firm is always horizontal, this implies that the marginal cost curve of every individual firm must be rising at every relevant level of output. And since the condition of perfect competition further implies that the price of labour is given for individual firms, rising marginal costs can only mean diminishing net physical products of labour. If this is true of every firm, it must be true of the system as a whole, provided that the distribution of aggregate output between different industries does not undergo any radical change; external economies being negligible in the short period. And if, as the output of the industry as a whole expands, the prices of raw materials, which the individual firms take as constant, rise relatively to wage rates because of the diminishing net returns to labour in those raw material producing industries, then the marginal net products of labour for the industry as a whole will fall all the more. Therefore, under the condition of perfect competition, if the system is in any equilibrium at all, the real wage rate in terms of the composite-product which the employers as a whole are willing to pay must be a declining function of aggregate employment and output. Consequently when in times of prosperity the upsurging effective demand brings about an increase in employment, there is thus an *a priori* reason why the real wages must fall, so long as in our short period, the amount of capital equipments and the state of technique, which determine the productivity functions of labour in the various industries, remain unchanged, and the condition of perfect competition is approximately fulfilled.

This type of argument concerning the movements of real wages in relation to the short period fluctuations of employment is implicit in those economists who approach the problem of employment with the marginal productivity theory, and who advocate that a general reduction of real wages is the only way to increase employment. It can be clearly observed in Professor Cannan's discussion of unemployment in his article "The Demand for Labour," where he remarked,

"General unemployment appears when asking too much is a general phenomenon,"[1] implying that given the productivity functions of labour in all industries, an increase in employment can only be secured at the cost of a reduction in real wages.

Professor Pigou in his earlier books on the problem of employment also analyses it with the aid of a downward sloping demand curve for labour in real terms. But since he chooses to express the real demand function for labour as well as real wages in terms of wage-goods only, the aggregate demand function for labour is therefore derived by a combination of marginal productivity theory and wage-goods fund (or rather, flow) theory.[2] It would seem to follow from his presumption of the downward sloping nature of his real demand function for labour that an increase in employment in the short period under the static framework would be associated with a decrease in real wages. But he regards the changes in employment even in the short periods as being chiefly brought about by the shifts in the real demand function for labour instead of consisting of movements along the same demand curve for labour. He is therefore not prepared to draw any *a priori* conclusion about the behaviour of real wages during the short period fluctuations of employment. His remarks about the movements of real wages in his earlier works, as we have mentioned above, are therefore generally of the nature of empirical generalizations as derived from observed facts.[3] In his latest book, *Employment and Equilibrium*, however, in spite of the fact that he has apparently been converted to the modern savings/investment approach for the determination of employment, he maintains on the *a priori* ground of stability condition similar to what we have outlined above that not only under perfect competition but also under imperfect competition, real wages in terms of the products of labour must be a diminishing function of employment. We shall analyse this proposition in greater detail later on when we have introduced imperfect competition into our argument.[4]

Substantially the same *a priori* argument regarding the movements of real wages in response to short-period changes in activities can be expressed in a different way. Thus we have the type of theory, which, instead of trying to define the movements of real wages directly by considering the marginal physical net product function, or the real demand function, of labour, seeks to analyse the relationship between the prices and the money wage rates by considering the shape of the marginal cost curves, or supply curves, in terms of wage-units. According to this school, the price-level is not something determined, as used

[1] *Economic Journal*, September, 1932, p. 367.
[2] See particularly *Theory of Unemployment*, Chaps. V and VI.
[3] *Vide supra*, p. 3. [4] *Vide infra*, Chap. II.

to be thought, entirely by monetary factors as distinguished from particular prices, but is determined in the same way by the conditions of demand and supply. If the supply curve for the output in general in terms of wage-units slopes upwards, then an increase in output and employment must be associated with a fall in real wages; and if the supply curve be downward sloping, increase in employment would be accompanied by a rise in real wages.

This is the line of argument taken by Lord Keynes and his followers. The basic assumption is that prices are always fixed so that marginal revenues always equal marginal costs, or that the actual market prices are always instantaneously adjusted to the supply prices. In the case of perfect competition, the assumption is that prices are always equal to marginal costs. According to Lord Keynes, it was Mr. R. F. Kahn who first employed this line of argument to attack the relation of the general level of prices to money wages, and he himself was influenced by it when he wrote his *General Theory*.[1] Since Lord Keynes in his *General Theory* was working under the assumption of perfect competition in a closed system, it is natural for him to presume that marginal cost curves in terms of wage-units in every industry must be rising for the whole relevant range. For, as we have observed above,[2] there cannot be any equilibrium for the individual firms under perfect competition unless the marginal cost curve for each individual firm is rising. And since each firm takes the money wage rate as given independently of its own action, rising marginal cost curve for each firm in money terms implies rising marginal cost in wage-units. Consequently when the firms as a whole are induced to expand their output, the prices of their products in general must rise relatively to the money wage rates, and real wages measured in the composite product of labour must fall. And this tendency would be reinforced by the tendency for raw materials and other prime costs to rise relatively to wages as aggregate output increases. It is this kind of *a priori* argument which leads him to conclude that "with a given organization, equipment and technique, real wages and the volume of output (and hence of employment) are uniquely correlated, so that, in general, an increase in employment can only occur to the accompaniment of a decline in the rate of real wages,"[3] and to put forth the proposition that in the case of changes in the general level of wages, the change in real wages associated with a change in money wages is almost always in the opposite direction.

It is easy to see that there is no substantial difference between the

[1] J. M. Keynes, "Relative Movements of Real Wages and Output," *Economic Journal*, 1939, p. 39, and R. F. Kahn, "The Relation of Home Investment to Employment," *Economic Journal*, June, 1931, *passim*; particularly pp. 178, 182.

[2] *Vide supra*, pp. 12–13.

[3] *General Theory of Employment, Interest and Money*, p. 17.

argument that real wages must fall as employment increases because of falling marginal net products of labour and the argument that prices must rise relatively to wages as employment increases because of rising marginal costs in wage-units. For falling marginal net physical products of labour imply rising marginal costs in wage-units and vice versa. There is, however, an important difference in outlook between the economists following these two alternative lines of argument. The economists who argue in the former way (and whom we may call the neo-classicals), generally approach the problem of the determination of the level of employment with the aid of a real demand function for labour and the rate of real wages as the supply price of labour. Although they maintain that the rate of real wages always tends to be equal to the marginal net product of labour in the sense that employment will tend to settle at the point where marginal net product of labour is equal to the rate of real wages, they nevertheless never fail to insist that the actual rate of real wages may diverge for some time from the marginal net product of labour. In other words, they would insist that prices can rise temporarily independently of marginal costs because of monetary reasons, or that marginal costs may fall or rise independently of prices because of, say, money wage reduction or increase. According to them it is such divergence between the marginal net products of labour and real wages that sets up the fluctuations of employment. To them, therefore, changes in real wages have some casual significance in the determination of the level of employment.

The Keynesian school, however, assumes that prices are always fixed so that marginal revenues are equal to marginal costs. In the case of perfect competition which we are now considering, the prices are assumed to be always equal to marginal costs and instantaneously adjusted to any change in the latter. The general price-level is therefore regarded by them as completely dependent and malleable, and rising or falling as dictated by the marginal costs in response to changes in employment or in money wages. It follows then that the actual rate of real wages, which depends on the relation between the price-level and the money wage rate, is also completely dependent and malleable, and will always accommodate itself to the marginal net productivity of labour expressed in real terms whatever the latter may be. This complete malleability and automatic adjustment of the rate of real wages thus deprive it of its claim in the Keynesian system as one of the determinants of the level of employment and activity, and leave that level free to be determined by the savings and investment functions. In short, the rate of real wages is regarded as employment-determined, instead of employment-determining.

Important as this difference in outlooks may be in the theory of

employment, it does not concern us much here. Both of these two types of *a priori* arguments agree that an increase in employment must be accompanied by a fall in the rate of real wages. It is only necessary to add that under the assumption of atomistic perfect competition which was posited by Lord Keynes as well as the orthodox economists, it is quite likely, as we have pointed out above, that the disequilibrium between prices and marginal costs may be more or less persistent if the level of employment is constantly changing. For under atomistic perfect competition the expansion of monetary effective demand must first raise the prices in the markets, and it is the rise of prices relatively to marginal costs that stimulates the producers to increase their output and employment; and conversely for the contraction of effective demand. But this tends only to reinforce the argument that real wages tend to fall as employment increases in the short period under the static assumption with regard to capital equipments, technique and organization.

Whichever approach we adopt, there is definite *a priori* reason to expect that under the assumption of constant capital equipment and technique real wages would vary inversely with the level of employment, provided that the condition of perfect competition obtains. It is now well known to economists, however, that the condition of perfect competition cannot be regarded as representative of the modern economy in the real world at all. For the condition of perfect competition implies three very stringent conditions with regard to the markets and the production of commodities. It requires in the first instance that the outputs of different producers in each industry must be perfect substitutes from the point of view of buyers, so that if one producer lowers his price alone by a slight proportion, he can get all the custom from his competitors in the same industry, and if he raises his price he will lose all his custom to his competitors. In other words, the cross elasticity of demand for the product of an individual producer with respect to the prices of other producers of the same commodity must be infinite. Secondly, there must be a very large number of producers producing the same homogeneous commodity and there must be no tacit agreement between them as regards price and output policies, so that the variation of the output by any individual producer alone makes no appreciable difference to the total supply of that commodity and consequently has no appreciable effect on price. Thirdly, the amounts of various factors of production demanded by each firm must be such small proportions of the total supplies available in perfect markets, that any variation in demand for factors by any individual firm causes no appreciable changes in the prices of factors.

In the real world, however, markets, particularly those of finished

products, are rarely perfect. The products offered by different producers, even though they may be conventionally classified as being the same "commodity,"[1] are more often than not more or less differentiated from each other, through such factors as real physical difference in quality, trade-marks, geographical locations of producers, buyers' preferences, rational or irrational, and so on. They are not, from the point of view of the buyers, perfect substitutes for each other. In other words, the cross elasticity of demand for the product of one producer with respect to the prices of his competitors in the same "industry" is no longer infinite, but has a finite value. In a large part of our economy each individual producer is, so to speak, a monopolistic producer of his own output, for which there are more or less close, but not perfect, substitutes. Therefore it is no longer true to say that the demand for the product of each representative individual producer is perfectly elastic. It will have a negative elasticity.

Furthermore, the imperfect substitutability between the products of different producers even within what is conventionally known as a single "industry" necessarily involves also the problem of oligopoly —i.e. the problem of few sellers. For when the products of different producers in an "industry" are but imperfect substitutes, it is unlikely that the different producers' products will possess the same degree of substitutability in relation to any other particular product. That is to say, any particular producer will always be faced with some rival products which are near his own in the chain of substitutes, and others which are farther off. If he varies his output or price, the impact will concentrate on the sales of the few rivals which are close substitutes to his product, instead of spreading evenly and widely among a large number of products so that the effect on the sale of each of them can be neglected, as it would be if the products of the "industry" were homogeneous and the number of producers large. Thus every individual producer will normally expect that a variation

[1] Under imperfect markets there cannot be a clear-cut definition of what consists of a commodity. Under the assumption of perfect markets, it is easy to define a commodity as a group of products or articles that are homogeneous and identical. When there is market imperfection, such homogeneity no longer exists. Nor can we define a commodity as a group of articles which compete against each other to satisfy a single demand. For every product must have some rivals, and in the last resort every product represents a use of income, yielding utility or satisfaction, which is competitive to other uses. Mrs. Robinson suggests that a rough and ready way of defining a single commodity is to regard it as a group of more or less close substitutes surrounded on each side by a marked gap in the chain of substitutes consisting of all want-satisfying articles. It may be that it is the existence of such natural gaps in the chain of substitutes that gives rise to the conventional classification of products into commodities. An industry is then any group of producers producing a single commodity. However, such definition is not always satisfactory and may sometimes be so blurred as to be misleading. For there is no reason to assume that the gaps in substitutability will coincide for every product in any group so as to form a common boundary for the whole group.

of his own output policy will probably bring about some reactions from his closest competitors, which will in turn affect his own price. This sort of oligopolistic problem is accentuated by the modern tendency of large-scale production and industrial concentration.

How important the problem of monopsony—i.e. the imperfection of competition in factor markets—is in the real world is difficult to say in general terms. But it is undoubted that in modern economy a representative individual producer is normally confronted with an expected demand for his product which has an elasticity less than infinity.

The admission of imperfect competition has important consequences upon the *a priori* argument regarding the movements of real wages in relation to short period fluctuations of employment. As a convenient starting-point, we assume with the Keynesian school that all prices are always fixed so that marginal revenues are equal to marginal costs—i.e. that prices are always in equilibrium with costs.

The first consequence would be that the rate of real wage of labour is not equated in value to marginal physical net product of labour, as is the necessary condition for the maximization of profit under perfect competition. For the demand for the product of an individual firm is no longer infinitely elastic. When a single firm expands its output independently, it must expect some fall in the price of its product. Consequently the increment to the total revenue of each individual producer is not the value of the increment of his product, but the latter minus the reduction in value, due to the fall in price brought about by the increase in output, of the original amount of output, which he expects to occur under given expected demand condition for his product. It has been shown that the expected marginal revenue due to a slight increase in output is equal to the value of the incremental product multiplied by a factor $\frac{e-1}{e}$, where e is the elasticity of the entrepreneur's expected demand for his product. The condition for the maximization of profit requires that marginal revenue in this sense be equated to marginal costs. In the absence of monopsony in labour market, this implies that real wage rate in terms of the product concerned is equated in value to the marginal gross product of labour multiplied by $\frac{e-1}{e}$ minus the marginal costs of the appropriate co-operating prime factors in terms of the product.

In the case where there is imperfection in the labour market—i.e. where the supply curves of labour to the individual firms are not perfectly elastic but slope upwards—such as when an individual firm increases its employment independently of other firms, it will have to

pay a higher uniform wage rate; then the marginal labour cost is not the money wage paid to the marginal unit of labour, but this plus the increase in wage-payment to the originally employed labour units due to the higher money wage rate made necessary by the increased demand for labour. The maximization of profit would then require that this marginal labour cost, which can be shown to be equal to the actual wage rate multiplied by $\frac{E+1}{E}$, where E is the elasticity of supply of labour to the individual firm, be equated to the marginal revenue minus the marginal costs of the appropriate additional co-operating factors. This implies that real wage rate in terms of the product concerned would then be equal in value to (the marginal gross physical product of labour $\times \frac{e-1}{e}$ — the marginal cost of co-operating prime factors in terms of the product concerned) $\times \frac{E}{E+1}$.

Thus the movement of real wages in a particular individual firm in response to changes in output of that firm depends not only on the physical productivity function of labour and the supply functions of the co-operating factors, but also on how the elasticity of demand for its product and the elasticity of supply of labour to the firm varies as it changes its output and employment. An increase in the elasticity of demand would reduce the gap between the price and marginal cost and thus tend to result, *ceteris paribus*, in an increase in product-wage and conversely, a decrease in the elasticity of demand for the product would, *ceteris paribus*, lead to a fall in product-wage. Similarly an increase in the elasticity of supply of labour to the firm tends to raise real wages and a decrease to lower real wages.

Mutatis mutandis, when we are considering the industry as a whole, the relation between total employment and real wages does not depend only on the physical productivity functions of labour and the supply functions of other prime factors in terms of wage-units. We must also consider how the expected elasticities of demands for all the different products vary on the average as the aggregate employment and output changes, and how the elasticities of the supply of labour to the individual firms change on the average.

The variation of the elasticities of individual demands which we must consider here is not, however, the variation of the elasticities of demands along the individual expected demand curves, which is the relevant thing to consider when we are analysing the variation of output and employment by a particular firm alone. For when the employment and output of the industry as a whole increase, the individual demand curve confronting any particular firm is naturally

shifted, normally to the right[1] and its shape may be altered. The variation of the elasticity of demand along the original demand curve is therefore no longer relevant. What we must consider here is therefore the changes on the average of the elasticities of demands for the products of the different individual firms associated with the general shifts of the individual demand curves when output and employment in general expand. If the elasticities of demands for the individual products increase on the average as aggregate employment increases, the gaps between prices and marginal costs on the average will be reduced. This will have a tendency to offset such forces as might make for the decline of real wages as employment increases—e.g. the diminishing productivity of labour.

Similarly the variation of the elasticities of supply of labour to individual firms as aggregate employment changes must be considered in a similar manner. For the increase in aggregate employment in the economy as a whole is not unlikely to shift and to change the shape of the supply curve of labour to the individual firm. If the complex of supply curves of labour to the individual firms becomes less elastic on the whole as the aggregate employment and output expand, marginal labour costs would stand, on the whole, higher in relation to actual wage rate, and *ceteris paribus*, prices of products would rise in relation to wage. Conversely, if the complex of supply curves of labour to individual firms becomes more elastic as the aggregate employment increases, other things being equal, marginal labour costs tend to fall relatively to the actual wage rate and real wages tend to rise.

It seems likely that the average elasticity of the complex of supply curve of labour to the individual firms will decrease, or the degree of monopsony will increase, after the aggregate employment has expanded to a certain extent. For when most firms have employed more or less fully the labour forces normally attached to them, they will have to begin to offer higher wages to bid away labour from other firms if they desire further expansion, and the pressure for wage increase from their own labour forces would become more persistent. In so far as in reality the entrepreneurs do regard the increase of wage rates as the result of their own employment policy and take it into account in their calculation of marginal costs, this would tend to reduce the rate of real wages as employment reaches a certain high level.

It is, however, difficult to reason on *a priori* ground whether the elasticities of demands for the individual products will increase or decrease on the average as the level of employment and activities

[1] Unless the product of the firm concerned is an "inferior goods." (Cf. J. R. Hicks, *Value and Capital*, pp. 28–9.)

rises. Indeed Mr. Harrod has demonstrated that there is some very plausible reason why increasing aggregate employment and real income make for decreasing average elasticity of demands. His argument was put forward in his book on *The Trade Cycle* as The Law of Diminishing Elasticity of Demand. His argument is: "as individuals become more affluent their sensitiveness to price differences diminishes." For "as the utility of commodities consumed on the margin declines, as the pressure exerted by the shortage of funds on all purchases is relaxed, the troubles of adjustment loom larger. It becomes more sensible to follow the line of least resistance at the cost of wastage, since the marginal pleasures forgone in consequence of it are of less absolute importance and therefore more likely to be inadequate to compensate for the trouble of avoiding waste."[1] And conversely when output and real income decline, the elasticities of demands will increase, because the consumers "resent and resist the curtailment of their wonted pleasures and become willing to take great pains to seek ways and means for mitigating their hardships. Their efforts to find cheapness become strenuous and eager."[2] This may be readily granted. But it may be pointed out that Mr. Harrod looks at the problem only from the point of view of buyers' preferences. He was rightly criticized by Mrs. J. Robinson in that there are other factors which influence market imperfection and elasticities of demands in the opposite direction.[3] For instance, in the slump when output is low, cartels or tacit agreements between individaul producers are often formed to save profit, but when trade revives, they are often dissolved because of improving prospects of independent activity and the greater likelihood of the emergence of outside competitors. These factors may be strong enough to offset the tendency to increase market imperfection of the diminishing willingness on the part of buyers to look for cheaper substitutes, and to make for, on balance, increasing average elasticity of demands for individual products as the level of employment and output increases. It may be that the increasing average elasticity of individual demands may be strong enough to prevent the rate of real wages from falling, or even to make it rise as employment increases, at least over the lower and medium ranges.

Another consequence of the admission of imperfect competition is that marginal physical net product of labour need not always be falling as employment increases. Under perfect competition, as has been shown above, the condition of rising marginal costs or falling marginal net physical product of labour for each firm is necessary for the stability of the equilibrium of individual firms. Under imperfect

[1] *Op. cit.*, p. 21.
[2] *Op. cit.*, pp. 86–7.
[3] J. Robinson, review of R. F. Harrod, "The Trade Cycle," *Economic Journal*, December, 1936.

competition the case is different. Marginal costs for each individual firm need not be rising; for the equilibrium of the individual firms can be secured even under constant or diminishing marginal costs by the falling demand and marginal revenue curves. Indeed it is observed that when output and employment are at a relatively low level and excess capacities prevail, marginal prime costs in most firms may well be constant or even slightly falling over a considerable range, although when firms approach full capacity marginal costs are bound to rise sharply. If the costs of other prime factors than labour do not begin to rise in terms of wage-units as soon as employment begins to increase, this would mean that marginal net physical product of labour for the industry as a whole in terms of the composite-products may be constant, if not rising, or, in all probability, falling only very gently over a considerable range of employment.

This tendency, coupled with the possibility that the elasticities of demands on the average may increase as aggregate employment increases, may quite conceivably result in the rate of real wages being a constant or increasing function of the aggregate employment, at least until employment has reached such a high level that bottlenecks in plant capacities appear, or possibly the degrees of monopsony in labour market rise appreciably. Thus when imperfect competition is a prevalent phenomenon, the behaviour of the rate of real wages in response to short period changes in employment might conceivably be of any nature, even under the assumption of constant capital equipment and state of technique. The rate of real wages might possibly be rising, falling or remaining constant as employment and output increase.

So far we have assumed as a convenient starting point that prices are always fixed in equilibrium with, and instantaneously adjusted to, marginal costs, so that marginal revenues are always equal to marginal costs and profits maximized. But we have observed above that under the assumption of perfect competition, when the output is continuously expanding, prices are likely to be continuously higher than marginal costs; for such temporary disequilibrium between prices and marginal costs is the chief stimulus for the expansion of output and employment under perfect atomistic competition. We must consider now how far such disequilibrium is likely to happen in a world of imperfect competition and whether it is possible to argue *a priori* that it would affect the behaviour of real wages one way or the other.

Under imperfect competition, the prices of the individual product are more or less under the control of the individual producers. Each producer is confronted with a downward sloping demand curve, along which he chooses the most profitable price. A rise in demand need not imply a rise of market price, as is necessarily the case under perfect competition, where the individual demand curve confronting

each producer is horizontal. It usually means to the individual firm that more orders come in at the previous price. As his product possesses some individuality and buyers' goodwill must be considered, it is unlikely that he would let the increased demand drive up the price, while output is being adjusted, and he will probably only alter his price after due consideration of the marginal cost at an increased output and the new elasticity of demand. Therefore, there is less likelihood of the rising demand driving up the prices out of equilibrium with marginal costs and demand conditions, as under perfect competition. In fact when the firm regards frequent changes of prices as detrimental to buyers' goodwill, it is possible that the adjustment of prices might lag behind the rise of costs and wages. Thus it is difficult for us to argue by purely *a priori* reasoning whether the time-lag factor will affect the movements of real wages one way or the other during short-period fluctuations of activities.

Thus once it is admitted that imperfect competition is a prevalent phenomenon, no definite conclusion as to the relative movements of real wages and activities in the short period can be drawn from purely theoretical arguments. It is therefore of great interest to see what is the actual relation between the movements of the rate of real wages and the short-period fluctuations of employment and activities, whether the traditional notion about the movements of real wages does conform with fact in the real world where elements of imperfect competition have always existed, and finally whether the intensification of the imperfection of competition in recent years has brought about any conspicuous modification in the actual behaviour of real wages.

CHAPTER II

PROFESSOR PIGOU'S VIEW ON THE RELATION BETWEEN THE RATE OF REAL WAGES AND EMPLOYMENT IN HIS "EMPLOYMENT AND EQUILIBRIUM"[1]

OUR conclusion in the preceding chapter that under imperfect competition there is no necessary reason why the rate of real wages in terms of composite-product in the system as a whole should be falling as the level of employment rises appears to be at variance with Professor Pigou's view in his latest book *Employment and Equilibrium*. In this book, Professor Pigou has explicitly enumerated as one of the necessary stability conditions for the economic system the condition that, given the capital equipments and the state of technique, the rate of real wages in terms of the products of the labour concerned, in both the consumption goods and the investment goods industries, must be diminishing as employment increases, under imperfect competition no less than under perfect competition.[2] It is stated that "it is only those systems in short-period flow equilibrium, for which these conditions are satisfied, that are capable of maintaining themselves for more than a moment,"[3] and again that "a state of things in which this was not so could not, practically speaking, exist."[4] We shall venture to prove that this view is in fact born of misconception and cannot be upheld categorically for all cases, although it is true for one hypothetical case, and a very unrealistic one at that.

Before entering into a direct discussion of this question, we must first give a brief sketch of his theory for the determination of the equilibrium level of employment. At first sight, it appears that Professor Pigou has whole-heartedly adopted the Keynesian method of approach to the determination of the level of employment, viz. by means of the savings and investment functions, but it soon becomes clear that at the back of his mind his wonted method of determining the level of employment with the aid of a real demand function and the real supply price of labour still looms large, and, as we shall observe, is at the root of some confusions in his argument.

Adopting an equilibrium analysis which leaves out the time-lags and the processes of adjustments, he determines the short period equilibrium of the economic system by means of a set of equations which summarize the equilibrium conditions. First we have the

[1] This chapter was published, with some slight modification, in the *Economic Journal*, December, 1944.
[2] *Op. cit.*, Chap. III, pp. 73–5.
[3] *Ibid.*, p. 75.
[4] *Ibid.*, p. 88.

equation expressing the balance between *ex ante* savings and *ex ante* investment, which Professor Pigou, in order to avoid the confusion due to the use of different definitions, prefers to call the "supply of labour for investment" and the "demand for labour for investment," respectively. Thus we have—

$$\phi(r) = f\{r, F(x)\} \quad . \quad . \quad . \quad . \quad (I)$$

where on the left-hand side, $\phi(x)$ is the demand for labour for investment expressed as a function of one variable only—viz. the rate of interest, r, and on the right-hand side savings, or the supply of labour for investment, is expressed as a function of the rate of interest and the output of consumers' goods, $F(x)$, x being the amount of labour employed in the consumption industry. He excludes the current level of employment or the degree of utilization as one of the variables determining the investment demand on the ground that any reactions due to a variation in current production and employment belong to states of disequilibrium and therefore have no place in the consideration of short-period flow equilibrium, where there is a steady rate of employment alike in the investment and in the consumption industries.[1] One feels, however, that to exclude the possibility of employment variation would be tantamount to assuming away the very question of the stability of the short-period equilibrium; for the acid test for stability is to suppose a deviation from the equilibrium position and to examine whether such deviation would set up forces tending to revert the deviation or otherwise. But this objection does not directly concern our present problem. We shall leave this equation as Professor Pigou puts it.

For the second equation, we have—

$$y = f\{r, F(x)\} \quad . \quad . \quad . \quad . \quad (II)$$

which states that the amount of labour actually employed in the investment industries, y, is equal to the supply of labour for investment. This, because at equilibrium the value of savings is equal to the value of output of the investment industries, and the amount of labour employed is uniquely correlated with the value of output in terms of some real numeraire—e.g. the wage-unit.

The third equation is the money income function. With what Professor Pigou calls the normal banking policy (i.e. that which allows the rate of interest to rise or fall as the level of money income rises or falls), it takes the following form—

$$(K_1 + K_2)w = g(r) \quad . \quad . \quad . \quad . \quad (IIIa)$$

where w is the rate of money wage, and K_1 and K_2 are the values

[1] *Vide ibid.*, pp. 52–3.

of total outputs in terms of wage-units in the consumption and investment industries respectively. It can be readily shown that K_1 and K_2 are functions of the amounts of labour employed in those industries respectively. For the value of output in the consumption industry in wage-units is equal to the output $F(x)$ divided by the real wage rate in terms of consumption goods, which at equilibrium is equal to the real marginal value productivity of labour, i.e.—

$$\left(1 - \frac{1}{\eta_1}\right) F'(x),$$

where η_1 is the average elasticity of demand for the individual consumption goods and $F'(x)$ the marginal physical product of labour; both these latter items may also be regarded as functions of employment or output. Similarly,

$$K_2 = \frac{\psi(y)}{\left(1 - \frac{1}{\eta_2}\right)\psi'(y)},$$

where $\psi(y)$ is the output of investment goods, η_2 the average elasticity of demand for the individual investment goods and $\psi'(y)$ the marginal physical product of labour in investment goods industry.[1]

Professor Pigou further suggests a hypothetical case where the banking policy is directed to keep the price level of consumption goods constant. In such case, the above third equation yields place to a different one—

$$\frac{K_1}{F} w = C \text{ (constant)} \quad . \quad . \quad . \quad \text{(III}b\text{)}$$

K_1 being the total value in wage-units of the output of consumption goods and F the output,

$$\frac{K_1}{F} \cdot w$$

therefore gives the price level of consumption goods. And since

$$K_1 = \frac{F}{\left(1 - \frac{1}{\eta_1}\right)F'(x)},$$

this equation can be rewritten—

$$\frac{w}{\left(1 - \frac{1}{\eta_1}\right)F'(x)} = C \text{ (constant)} \quad . \quad . \quad \text{(III}b\text{)}$$

[1] F and ψ are regarded as functions of only one variable—viz. the amount of labour employed, labour being assumed as the only prime factor of production in the short period. (See *op. cit.*, p. 43.)

For the fourth equation, Professor Pigou suggests two alternative forms. The one, $(x + y) = Q$(constant), which implies that the total employment is always equal to the quantity of available supply of labour, may be omitted as rather unrealistic. The other supposes the condition that the money rate of wages is fixed by authority or collective bargaining in the short period, so that

$$w = T\,(\text{constant}) \quad . \quad . \quad . \quad .(\text{IV})$$

Thus we have four equations to determine four unknowns x, y, r, and w. The system is therefore determinate unless some of the functions are of exceptional shapes. In the case where the third equation takes the form of III*a*—i.e. $(K_1 + K_2)w = g(r)$—the system is analogous to Marshall's famous illustration of a number of balls lying together at the bottom of a bowl; the whole surrounding environment jointly determines the position of all. All the variables —i.e. x, y, and r, (w being given as a constant)—will be determined by all the equations together; no three equations alone can determine any of x, y, and r. But, it is very interesting to note that if on the other hand, the third equation takes the form of III*b*—i.e.

$$\frac{K_1}{F}w = \frac{w}{\left(1 - \frac{1}{\eta_1}\right)F'(x)} = C\,(\text{constant})$$

—the interdependence of the equations changes its nature. For constant price-level of consumption goods plus constant rate of money wage implies a constant rate of real wage in terms of consumption goods in general. Thus equations III*b* and IV result in

$$\left(1 - \frac{1}{\eta_1}\right)F'(x) = k\,(\text{constant}),$$

or in the condition that the marginal value productivity of labour in terms of labour's own product in the consumption industry is equated to a constant rate of product wage. Excepting the case where

$$\frac{d}{dx}\left\{\frac{1}{\left(1 - \frac{1}{\eta_1}\right)}F'(x)\right\} = O,$$

this equation is sufficient by itself to determine the value of x—i.e. the amount of employment in the consumption industry—irrespectively of the two other equations. Of these latter, the first equation —i.e. the equality between savings and investment—determines only the rate of interest, r, since x has already been determined, and the second determines y, the amount of employment in the investment

industry, only. Thus the marginal real value productivity function of labour in the consumption industry becomes the sole function determining the employment in that industry, if the third equation is

$$\frac{K_1}{F} \cdot w = C$$

and the rate of real wage in terms of consumption goods is thus maintained at a constant level; whereas if the third equation is $(K_1 + K_2)w = g(r)$, the marginal real value productivity functions of labour in the consumption industry as well as in the investment industry—i.e.

$$\left(1 - \frac{1}{\eta_1}\right) F'(x)$$

as a function of x and

$$\left(1 - \frac{1}{\eta_2}\right) \psi'(y)$$

as a function of y—will figure only in the money income function and will be directly relevant only for the determination of money income and the rate of interest.

Thus once the rate of real wage can be somehow regarded as a given constant, Professor Pigou's earlier theory of employment as elaborated in his *Theory of Unemployment* comes to its own again. The level of employment is determined by the rate of real wage and the real demand function for labour. The equality between savings and investment is relevant only directly for the determination of the rate of interest, though it may exert some influence on the amount of employment in the investment industry through the equation II.

This interesting mutation of the nature of the interdependence of these equations was not explicitly noted by Professor Pigou himself, but was only hinted at in a footnote where he pointed out that the system would be indeterminate when the third equation is

$$\frac{K_1}{F} w = C$$

and

$$\frac{d}{dx}\left(\frac{K_1}{F}\right) = 0.^1$$

To bear this point in mind, however, will help us in clearing up the confusion about the stability conditions of the system and the possible movements of real wage rates in relation to changes in employment.

[1] *Op. cit.*, p. 69, footnote.

When discussing the stability conditions of the system, Professor Pigou points out that the establishment of any equilibrium entails the following equalities—[1]

(1) $$\phi(r) = f\{r, F(x)\},$$

(2) $$\left(1 - \frac{1}{\eta_1}\right) F' = W_1,$$

where W_1 is the real wage rate in terms of consumption goods in general.

(3) $$\left(1 - \frac{1}{\eta_2}\right) \psi' = W_2,$$

where W_2 is the real wage rate in terms of investment goods in general.

The first is the equality between savings and investment, which is also the first equation for the determination of the system. The two latter equalities, which imply that marginal value productivity of labour in terms of the product of the labour concerned must be equal to the rate of product-wage, have not been enumerated as the fundamental equations, but they are implied in the third equation, the money income equation, when it takes the form $(K_1 + K_2)w = g(r)$. And, as we have seen above, in the case where the third equation is

$$\frac{K_1}{F} \cdot w = C,$$

W_1 would be a constant and

$$\left(1 - \frac{1}{\eta_1}\right) F' = W_1$$

would uniquely determine the employment and output in consumption industry.

From the first equality, Professor Pigou derives the following stability conditions—

(1) $$\left(\frac{\partial f}{\partial r} - \phi'\right) > 0,$$

2) $$\frac{\partial f}{\partial x} > 0 \quad \text{or} \quad F' \frac{\partial f}{\partial F} > 0.$$

The first implies that a rise in the rate of interest from the equilibrium position would cause savings to exceed investment, or, in Professor Pigou's terminology, would cause the supply of labour for investment to exceed the demand for labour for investment, and thus set up

[1] Cf. *op. cit.*, Part II, Chap. III, "Stability Conditions."

forces tending to bring the rate of interest back to equilibrium (either directly in the capital market or indirectly through the level of money income). And conversely for a downward deviation of the interest rate from the equilibrium position. The second implies that an increase in employment from the position of equilibrium, given the rate of interest, would cause savings to exceed investment, thus providing a counterforce to restore equilibrium.

This is quite familiar. But we may disagree with Professor Pigou in his opinion that both these conditions (and two others) must be satisfied if equilibrium is to be maintained for more than a moment.[1] To use a very useful distinction made by Professor Hicks, we may point out that both of these conditions are required at the same time only if the system is to be in perfect stability—i.e. a condition under which a deviation from equilibrium in one particular sphere of the system would directly set up forces tending to restore equilibrium without allowing for the reactions in other spheres as well as after these reactions are allowed for.[2] But the system may yet be ultimately stable—i.e. in imperfect stability—even if one of these two conditions is not strictly satisfied; the tendency to move away from equilibrium in one sphere may be checked in the end through the repercussions in other spheres. For instance, if the first stability condition is satisfied, the system may yet be stable, though imperfectly, even if the second condition is not strictly satisfied. For if an increase of employment does not directly result in an excess of savings over investment, the system may yet be prevented from running away from equilibrium, if the increase in employment leads, as it normally would given the money wage rate, to an increase in money income, which under a "normal banking policy" would cause a rise in the rate of interest, and thus eventually bring about an excess of savings over investment indirectly through the rate of interest. Similarly, if the second condition of stability is satisfied, the system may yet be imperfectly stable, if the first is not strictly satisfied. For instance, if a deviation, say an upward one, of the rate of interest from the equilibrium position does not result in an excess of savings over investment, but, on the contrary, in an excess of investment over savings, the level of income and employment would rise. And with "normal banking policy" this would cause the rate of interest to rise further. But if the second stability condition holds, the rise of employment would bring about an increase in savings relative to investment, which might in the end check the rise of the interest rate and employment.

[1] *Op. cit.*, p. 75.

[2] J. R. Hicks, *Value and Capital*, Chap. V, especially pp. 66–7, and Chap. XX. This point has also been pointed out by Mr. Kaldor in his review of Professor Pigou's book in the *Economic Journal*, December, 1941.

Allowing for the mutual repercussions, the ultimate condition of stability based on Professor Pigou's system of equations, with the third equation taking the form $(K_1 + K_2)w = g(r)$—i.e. with a "normal banking policy"—may be formulated as follows—

$$(3)\quad F'\frac{\partial f}{\partial F} + \frac{\partial f}{\partial r}\cdot\frac{d\{(K_1 + K_2)w\}}{\partial x}\cdot\frac{1}{g'} > \phi'\cdot\frac{d\{(K_1 + K_2)w\}}{\partial x}\cdot\frac{1}{g'}.$$

If this condition is satisfied, the system as a whole is ultimately stable. If not, the system is not even imperfectly stable, but will break down at the slightest disturbance.

This co-ordinated stability condition also brings out where the money income equation and its component functions—i.e. $K_1 = K_1(x)$, $K_2 = K_2(y)$ and the real marginal value productivity functions of labour in the consumption and investment industries, come in with respect to the problem of stability. It is easy to see from this co-ordinated stability condition that if the stability condition (1) is satisfied and the banking policy is normal, so that g' is positive, as long as

$$\frac{dK_1}{dx} > 0 \text{ and } \frac{dK_2}{dy} > 0$$

—i.e. as long as the value of output in the consumption or investment industry increases in terms of wage-units as employment and physical output increase in the respective industries—the influence of K_1 and K_2 is always in the stabilizing direction. And the condition for

$$\frac{dK_1}{dx} = \frac{d}{dx}\left\{\frac{F(x)}{\left(1 - \frac{1}{\eta_1}\right)F'(x)}\right\} > 0$$

is simply that the real marginal value productivity of labour in terms of the product in the consumption industry, which in equilibrium is equal to the real rate of wage, must increase at a slower rate than the total physical output of the consumption industry—i.e.

$$\frac{F'(x)}{F(x)} > \frac{d}{dx}\left\{\left(1 - \frac{1}{\eta_1}\right)F'\right\}\Big/\left(1 - \frac{1}{\eta_1}\right)F'$$

which can be rewritten

$$\frac{d}{dx}\left\{\left(1 - \frac{1}{\eta_1}\right)F'\right\} < \frac{F'}{F}\left(1 - \frac{1}{\eta_1}\right)F'.$$

Similarly, the condition for

$$\frac{dK_2}{dy} = \frac{d}{dy}\left\{\frac{\psi}{\left(1 - \frac{1}{\eta_2}\right)\psi'}\right\} > 0$$

is simply that the real product-wage rate in the investment industry must increase at a slower rate than the total output of that industry —i.e.

$$\frac{\psi'}{\psi} > \frac{d}{dy}\left\{\left(1-\frac{1}{\eta_2}\right)\psi'\right\}\Big/\left(1-\frac{1}{\eta_2}\right)\psi',$$

which can also be written

$$\frac{d}{dy}\left\{\left(1-\frac{1}{\eta_2}\right)\psi'\right\} < \frac{\psi'}{\psi}\left(1-\frac{1}{\eta_2}\right)\psi'.^{1}$$

For the stability of the whole system with a normal banking policy, therefore, it is quite unnecessary that the rate of product-wage in the consumption and investment industries should always be falling as employment increases. So long as the rate of product-wage does not increase as fast as the physical output, as the level of employment rises, its influence would still be stabilizing rather than destabilizing, provided that the stability condition (1) is satisfied.

Professor Pigou, however, further includes the conditions

$$\frac{d}{dx}\left\{\left(1-\frac{1}{\eta_1}\right)F'\right\} < 0, \tag{4}$$

$$\frac{d}{dy}\left\{\left(1-\frac{1}{\eta_2}\right)\psi'\right\} < 0, \tag{5}$$

among the necessary stability conditions for the system as a whole, and he holds that "no position of general equilibrium will be stable unless

$$\frac{d}{dx}\left\{\left(1-\frac{1}{\eta_1}\right)F'\right\}\text{—namely, } -\frac{dW_1}{dx}$$

—is negative," and that "a state of things in which this was not so could not, practically speaking, exist."[2] This is obviously contrary to our conclusion above and to our argument in the preceding chapter. We shall now examine where the confusion creeps in.

Professor Pigou appears to think that these stability conditions follow naturally from the familiar proposition that "it is a necessary

[1] Professor Pigou has also mentioned in his book that K'_1 and K'_2 must be positive (*ibid.*, p. 76). He derives this, however, from the alleged stability conditions

$$\frac{d}{dx}\left\{\left(1-\frac{1}{\eta_1}\right)F'\right\} < 0 \text{ and } \frac{d}{dy}\left\{\left(1-\frac{1}{\eta_2}\right)\psi'\right\} < 0.$$

As is clear from what we have observed above, although

$$\frac{d}{dx}\left\{\left(1-\frac{1}{\eta_1}\right)F'\right\} < 0 \text{ and } \frac{d}{dy}\left\{\left(1-\frac{1}{\eta_2}\right)\psi'\right\} < 0$$

necessarily imply that K'_1 and K'_2 must be positive, the converse is not necessarily true.

[2] *Ibid.*, pp. 87–8.

condition of stability, alike for perfect competition, for imperfect competition and for monopoly, that the marginal revenue curve shall lie above the supply curve of each firm affected to the left of the point of intersection between them."[1] In other words, he believes that the condition that the product wage rates for the industry as a whole must be falling as the level of employment increases follows from the stability condition of the individual firms The question is whether this deduction is in fact warranted or not. Our argument in the previous chapter, however, is that it is true only under perfect competition but not so under imperfect competition. It is easy to prove this with the aid of mathematical symbols.

Let x_n denote the amount of labour employed in a particular firm N, $F_n(x_n)$ the production function of that firm (assuming with Professor Pigou for the sake of simplicity that labour is the only prime factor), p_n the money price of the firm's product, and η_n the elasticity of individual demand for the product of the firm. The equilibrium condition of the particular firm N—i.e. the equality between the marginal revenue and marginal cost—can then be written—

$$p_n\left(1-\frac{1}{\eta_n}\right)=\frac{dx_n}{dF_n}\cdot w,$$

where w is the money wage rate, which under the assumption of Professor Pigou that monopsony is non-existent, is constant to the individual firm. This equation can be rewritten—

$$\frac{dF_n}{dx_n}\left(1-\frac{1}{\eta_n}\right)=\frac{w}{p_n},$$

where the left-hand side is the marginal value productivity of labour in terms of the product of the firm and the right-hand side is the rate of real wage in terms of the product concerned. The stability condition of the firm—i.e. the requirement that the marginal cost curve of the firm must cut its marginal revenue curve from below—can be represented—

$$\frac{d}{dx_n}\left\{\left(1-\frac{1}{\eta_n}\right)F'_n\right\}<\frac{d}{dx_n}\left(\frac{w}{p_n}\right).$$

Under perfect competition,

$$\frac{w}{p_n}$$

must be regarded as constant from the point of view of the individual firm because both the money wage rate and the price of the product are beyond the influence of the individual firm. And since η_n under

[1] *Ibid.*, p. 72.

perfect competition is infinite, the stability condition of the firm therefore reduces to—

$$F''_n < 0,$$

which implies that the marginal physical product of labour and the product-wage rate must be a diminishing function of employment. If this condition must obtain for every firm in the economy, then it may be safely applied to the economic system as a whole.[1] The rate of real wages of labour in terms of labour products in general must be falling as the level of employment increases, provided there is no change in the production functions.

Under imperfect competition, however, the case is quite different. For even though the money wage rate is constant,

$$\frac{w}{p_n}$$

—i.e. real wage rate in terms of labour's own product—can no longer be regarded as constant by the individual firm. A change in p_n will change the rate of product wage. And since

$$\frac{dp_n}{dx_n}$$

is always negative because of the downward sloping individual demand curve,

$$\frac{d}{dx}\left(\frac{w}{p_n}\right)$$

must always be positive. Thus the stability condition for the individual firm cannot be reduced to

$$\frac{d}{dx_n}\left\{\left(1-\frac{1}{\eta_n}\right)F'_n\right\} < 0,$$

but remains

$$\frac{d}{dx_n}\left\{\left(1-\frac{1}{\eta_n}\right)F'_n\right\} < \frac{d}{dx}\left(\frac{w}{p_n}\right) > 0.$$

This implies that stability of the firm is compatible with

$$\frac{d}{dx_n}\left\{\left(1-\frac{1}{\eta_n}\right)F'_n\right\} > 0$$

so long as it is smaller than

$$\frac{d}{dx_n}\left(\frac{w}{p_n}\right)$$

[1] External economics, as Professor Pigou has pointed out, may be ignored in the short period. Cf. *ibid.*, p. 75.

which may be rewritten

$$w \cdot \frac{F'_n}{F_n} \cdot \frac{\eta_n}{p_n}$$

and which is always a positive magnitude. Therefore it is impossible to deduce from the stability, or the maximization, condition of the individual firms that the rate of real wage in terms of labour's products in general in the industry as a whole must be falling with the increase of employment.

Professor Pigou apparently has mistakenly assumed that the product wage rate for each firm—i.e.

$$\frac{w}{p_n}$$

—may be regarded as constant. For on p. 73 of his book, he remarks that "these (viz. W_1 and W_2—i.e. the wage-rate in terms of consumption goods in general and that in terms of investment goods in general), as against individual firms, are obviously constant" and then proceeds to draw the conclusion that

$$\frac{d}{dx}\left\{\left(1 - \frac{1}{\eta_1}\right)F'\right\} < 0 \text{ and } \frac{d}{dy}\left\{\left(1 - \frac{1}{\eta_2}\right)\psi'\right\} < 0$$

are the necessary stability conditions. But it should be obvious from what we have said that what is relevant for the consideration of the stability of the individual firm is not W_1 or W_2—i.e. the money rate of wage divided by the price level of consumption goods in general or by that of investment goods in general, but the wage-rate in terms of the firm's own product—i.e.

$$\frac{w}{p_n}.$$

To assume that

$$\frac{w}{p_n}$$

is constant for each individual firm would imply that each firm takes the price of its own product as given independently of its own output policy, and that would be tantamount to assuming away the very existence of imperfect competition.

Professor Pigou might perhaps argue that, in order to confine his attention to the determination of the general level of employment, he has expressly postulated, for the sake of simplicity, that the relative prices of different commodities will always remain the same (*ibid.*, p. 43), so that given w,

$$\frac{w}{p_n}$$

cannot change unless the general level of prices changes. And since prima facie it may be granted that an individual firm is powerless in altering the general price-level by its own independent action, therefore

$$\frac{w}{p_n}$$

may be considered as constant as against individual firms. But even though we may usefully postulate for the discussion of the general equilibrium level of employment that *ex post facto* the relative prices of different commodities somehow always remain the same, it would involve absurd implications to use it as a restrictive condition for the analysis of the stability of the individual firms—that is, to assume that each firm, while making decisions regarding its output and price, expects *ex ante facto* the price of its own product to remain always the same relatively to other prices. For this would imply either that the individual firm expects the price of its own product to be constant irrespectively of its own policy, or that there is a universal collusion whereby it is understood that if one firm alter its price, other firms would immediately follow suit and change their prices by the same proportion. In the former case, imperfect competition would be excluded *ex hypothesi*; in the latter case, there would be, in fact, no independent firms at all, but an all-inclusive monopolistic combine.

Furthermore, under imperfect competition, we must particularly beware of a sort of fallacy of composition in inferring from the stability condition for the individual firm to that for the industry as a whole. For as we have pointed out in the previous chapter,[1] the elasticity of demand as a function of output or employment relevant for the stability consideration of the individual firm is the variation of the elasticity of demand along the individual demand curve in connection with an independent change of output by the firm concerned alone. But when we are considering the industry as a whole, the functional variation of the average elasticity of demands in relation to a change in aggregate employment and real income is not the average of the variation of the elasticities of individual demands along given individual demand curves. For when the employment and output of the system as a whole increase, the demand curve for any particular firm will generally be shifted, normally to the right, and some change in its elasticity will generally occur. The variation of the elasticity of demand along its original individual demand curve is no longer relevant. Thus, when we are considering the relation between real wage rate and employment in the system as a whole, the average elasticity of demands must be conceived as a function of the aggregate employment and real income, so as to include the effect of the shifts

[1] *Vide supra*, pp. 22–3 *et seq.*

of the individual demand curves upon the average elasticity of demands; whereas for the stability of the individual firms it is only the variation of the elasticity of demand along a given individual demand curve that is to be taken into account, for in deciding its own output, the individual firm cannot presume that all other firms will follow it in increasing or contracting their output. The functional relationship between the elasticities of individual demands and the aggregate employment or the total real income is something of the nature of "external economies (or diseconomies)" to the individual firms, and is not relevant for the stability or maximization condition of the firms.

Therefore in the case where the average elasticity of individual demands is an increasing function of aggregate real income—i.e. the individual demand curves become more elastic as they are shifted forward by the increasing real income—increasing real wage rates in the industry as a whole as the level of employment is increased may yet be compatible with the stability condition of the firms, even if that condition were

$$\frac{d}{dx_n}\left\{\left(1-\frac{1}{\eta_n}\right)F'_n\right\} < 0$$

And since, as we have seen above, the stability condition of the individual firm is in fact

$$\frac{d}{dx_n}\left\{\left(1-\frac{1}{\eta_n}\right)F'_n\right\} < \frac{d}{dx_n}\left(\frac{w}{p_n}\right) > 0$$

therefore, it is possible *pro tanto* for the rate of real wage in terms of labour's products in general to increase all the more with rising level of employment in the system as a whole without overstepping the stability condition of the firm.

As regards the stability of the whole system, we have seen above that with a normal banking policy the general equilibrium is stable so long as the co-ordinated stability condition (3)—i.e.

$$F' \cdot \frac{\partial f}{\partial F} + \frac{\partial f}{\partial r} \cdot \frac{d\{(K_1 + K_2)w\}}{\partial x} \cdot \frac{1}{g'} > \phi' \cdot \frac{d\{(K_1 + K_2)w\}}{\partial x} \cdot \frac{1}{g'}$$

—is satisfied. If the stability conditions (1) and (2)—i.e.

$$\left(\frac{\partial f}{\partial r} - \phi'\right) > 0 \text{ and } F' \frac{\partial f}{\partial F} > 0$$

—are also satisfied, that condition would leave ample possibility for the rate of product wages in both the consumption and investment industries to rise with the level of employment without upsetting the stability of the general equilibrium. Thus pure *a priori* argument is

unable to provide any definite answer as to the possible relationship between the movement of real wages and that of the level of employment, once imperfect competition is a prevalent phenomenon.

There is, however, one case where

$$\frac{d}{dx}\left\{\left(1-\frac{1}{\eta_1}\right)F'\right\} < 0$$

does become a necessary condition for the stability of the whole system. That is the case where the banking authority is supposed to keep the prices of consumption goods constant—i.e. where the third equation for the determination of the general equilibrium is

$$\frac{K_1}{F}\,.\,w = \overline{\frac{w}{\left(1-\frac{1}{\eta_1}\right)F'}} = C \text{ (constant)}.$$

We have already seen that when this is the case and the money wage rate is also constant, the employment in the consumption industry is determined entirely by the condition that

$$\left(1-\frac{1}{\eta_1}\right)F' = W_1 \text{ (now also a constant)},$$

and the neo-classical theory of employment, which contends that employment is determined by the real demand function for labour and the real supply price of labour, comes to its own again. In such a case, of course, stability of employment cannot be maintained unless

$$\frac{d}{dx}\left\{\left(1-\frac{1}{\eta_1}\right)F'\right\} < 0.$$

But this is true only for this hypothetical case where the monetary authority is supposed to keep prices stable and to succeed in doing so in all circumstances. It cannot be said to be a necessary stability condition under other and more realistic circumstances. One cannot help feeling that perhaps it is the eagerness to make the best of the preconceived "classical view on employment"[1] which causes such an acute mind as Professor Pigou's to overlook the complexities involved in this problem.

[1] Cf. *ibid.*, Chap. IV.

CHAPTER III

STATISTICAL OBSERVATIONS OF THE RELATIVE MOVEMENTS OF REAL WAGES AND BUSINESS ACTIVITY

THE conclusion of our last chapter has been entirely negative. It was shown there that in a world where imperfection of competition is a prevalent phenomenon—and this is now recognized as the condition of our real world—it is impossible to predict, on purely *a priori* grounds, the manner in which the fluctuations of the average rate of real wages, apart from those due to technological improvements and capital accumulation, would be correlated with the short period fluctuations in employment. Theoretically all sorts of correlation are possible. Neither the traditional "lag theory" nor the "diminishing physical returns to labour theory" would provide us sufficient *a priori* reason to expect a definite type of relationship between the short period fluctuations of real wage rates and those of output in the real world where imperfect competition is known to have always been more or less prevalent. Such theoretical uncertainty cannot but whet our curiosity to observe the actual relationship between the short period fluctuations of real wages and employment.

Moreover, as we have mentioned in the introduction, the recent inquiries by Drs. Dunlop and Kalecki[1] appear to contradict the hitherto widely accepted notion that real wages tend to move in the opposite direction with business activity and employment. It is therefore of great interest to examine in some detail from the available statistics how the fluctuations of the average rate of real wages, with long period trend eliminated, is in fact correlated with the short period fluctuations of employment and output.

Some such inquiries have indeed been made in the past. Marshall himself quoted some statistical evidence to support his "lag theory" of the movements of real wage rates, when he put it forward before the Committee on Indian Currency. After explaining his views on the effect upon real wages of changes in prices in Question 11780, as we have quoted above,[2] he proceeded in the next question to discuss the evil of credit inflation in encouraging speculation and fraudulent enterprises which inevitably result in ensuring depression, and explained why he had abandoned the erroneous doctrine that a rise in prices was generally beneficial to business men directly and indirectly to the working class and adopted his new opinion. He then produced as statistical proof for his view on the movements of real wages the accompanying table, which was reproduced from an article

[1] *Vide supra*, pp. 3–4. [2] *Vide supra*, p. 9.

by Professor Bowley in the *Economic Journal* for December, 1898.[1] Marshall remarked there—

"The assertions that a rise in prices increased the real wages of the worker were so consonant with the common opinion of people who had not specially studied the matter, that it was accepted almost as an axiom; but, within the last ten years, the statistics of wages have been carried so far in certain countries, and especially in England and America, that we are able to bring it to a test. I have accumulated a great number of facts, but nearly everything I have accumulated is implied in this table. It is copied from the article by Mr. Bowley in the *Economic Journal* for last December. It is the result of work that has been going on for a number of years, and seems to me practically decisive. It collects the average wages in England from the year 1844 to the year 1891, and then calculates what purchasing power the wages would give at the different times, and it shows that the rise of real wages after 1873 when prices were falling was greater than before 1873 when prices were rising."[2]

AVERAGE REAL AND NOMINAL WAGES IN THE UNITED KINGDOM, FRANCE AND THE UNITED STATES, AS PERCENTAGES OF THOSE IN 1891[3]

Country		1844–53	1854–63	1864–73	1874–83	1884–93	1891
United Kingdom .	Nominal	61	73	82	93	95	100
	Real	53	51	59	82	97	100
France . .	Nominal	52	65	73	86	95	100
	Real	55	61	67	78	94	100
United States .	Nominal	53	58	72	86	95	100
	Real	54	53	57	76	95	100

But as is obvious at first sight, this table gives only the average real and money wage rates for ten-year periods. It therefore tells us nothing whatever about the short period movements of real wage rates in response to the short period fluctuations of business activity and prices during the course of the Juglar trade cycles. It makes one suspect that perhaps what Marshall then had in mind was the influence upon the trend of real wages of the comparatively long period waves of price movements, which constitute the so-called Kondratieff

[1] *Official Papers*, pp. 284–7.

[2] It is interesting to contrast this remark with Foxwell's observation, which maintained exactly the opposite. (*Vide supra*, p. 7, footnote 1.)

[3] Professor Bowley's index of real wages in this table is computed by dividing the money wage index with the wholesale prices index. In the case of the United Kingdom, the Sauerbeck index of wholesale prices was used.

cycles, generated perhaps by the up-and-down trends of gold production, the exploitation of technical innovations (e.g. equipment of a country with railroads) or newly discovered countries; although the reliance of his theory on the time-lag of wage adjustments and his reference to currency inflations and the inevitably following depressions immediately above would make this rather unlikely. However, even if his concern was the influences of the long Kondratieff waves of prices, the evidence of this table is far from being decisive. For the fact that the upward trends of real wage rates were steeper after 1873 might simply be due to greater speed in technological improvements and in the consequent increase of the productivity of labour and monetary factors might have little to do with it in such a long run.

The more thorough investigations of the year to year fluctuations of real wages made by Dr. Dunlop[1] and Lord Keynes[2] himself, however, show exactly the opposite result. That is to say, the rate of real wages is generally found to rise in times of high activity and to fall during low activities. Both Dr. Dunlop and Lord Keynes computed their index of real wages by dividing the index of money wages with that of the cost of living. And Dr. Dunlop also corrected the cost of living index for the influence of changes in the terms of trade on the costs of imported food and clothing, but he added that whether these corrections were made or not did not affect the essential character of the result. His result in this connection is summarized in his table on p. 419, which we reproduce below in a slightly altered form.

Years	Phase	Real Wage Rates (with Trend Removed up to 1900)[3]
1860–1862	Downswing	− 2·6
1862–1866	Upswing	+ 6·2
1866–1868	Downswing	− 9·2
1868–1873	Upswing	+ 7·2
1873–1879	Downswing	− 0·6
1879–1883	Upswing	− 3·0
1883–1886	Downswing	+ 2·7
1886–1890	Upswing	+ 5·1
1890–1893	Downswing	− 5·0
1893–1900	Upswing	+ 7·8
1900–1904	Downswing	− 7·0
1904–1907	Upswing	+ 3·7
1907–1909	Downswing	− 3·4
1909–1913	Upswing	+ 1·2

[1] "The Movement of Real and Money Wage Rates," *Economic Journal*, September, 1938.

[2] "Relative Movements of Real Wages and Output," *Economic Journal*, March, 1939.

[3] The index of real wage rates since 1900 has not been corrected for trend, for in the thirteen years before the last war, real wage rates show almost no trend—if any were calculated it would be slightly negative in slope.

As can be easily read off from the table, real wage rates had always increased during the upswings and fallen during the downswings, except during the period from 1879 to 1886. The traditional notion that real wages are negatively correlated with employment and activity appeared to hold good only by exception for the upswing from 1879 to 1883 and the downswing from 1883 to 1886, but for no other periods during the whole stretch of fifty-four years from 1860 to 1913!

The independent comparison made by Lord Keynes as a check for Dr. Dunlop's computation has entirely confirmed his result. Can it be that, as Lord Keynes put it, "we have been living all these years on a generalization which held good, by exception, in the years 1880–86, which was the formative period in Marshall's thought in this matter, but has never once held good in the fifty years since he crystallized it?"[1] If so, it would indeed be an astonishing fact and would reflect ill upon the credulity of the economists.

The index for real wage rates of Dr. Dunlop and Lord Keynes, however, as we have already mentioned, was obtained by dividing the index of money wage rates with the index of the cost of living; whereas the theoretical argument about the relative movements of real wages and activity, whether it be the "lag theory" of the type put forward by Marshall or that which is based on the diminishing return to labour as used by Lord Keynes, really concerns the real wage rates in terms of the labour's own products in a closed system. We should therefore compute the index of the real wage rates relevant for our purpose by dividing the index of average money wage rates with the price index of the current products of the labour in question. The prices of imported goods in an open system, usually also included in the wholesale price index, and the prices of goods which are not currently produced and whose prices are consequently not governed by the current marginal costs, and are usually very sticky—e.g. house-rent, which bulks large in the cost-of-living index—would clearly cause complications. Although Dr. Dunlop has corrected his cost-of-living index for changes in Great Britain's terms of trade affecting the costs of food and clothing, the sticky elements of house-rent and rates included in the cost of living might still interfere with the reliability of the abstract reasoning. Furthermore, we must notice that even if we calculate the real wage rates in terms of the current products of the domestic labour in question, the influence of changes in the international terms of trade is not thereby entirely eliminated. For domestic products may be produced with imported raw materials. A cheapening of imported raw materials relatively to domestic labour prices would, *ceteris paribus*, reduce the prices of the products produced with those raw materials in relation to the prices of domestic labour,

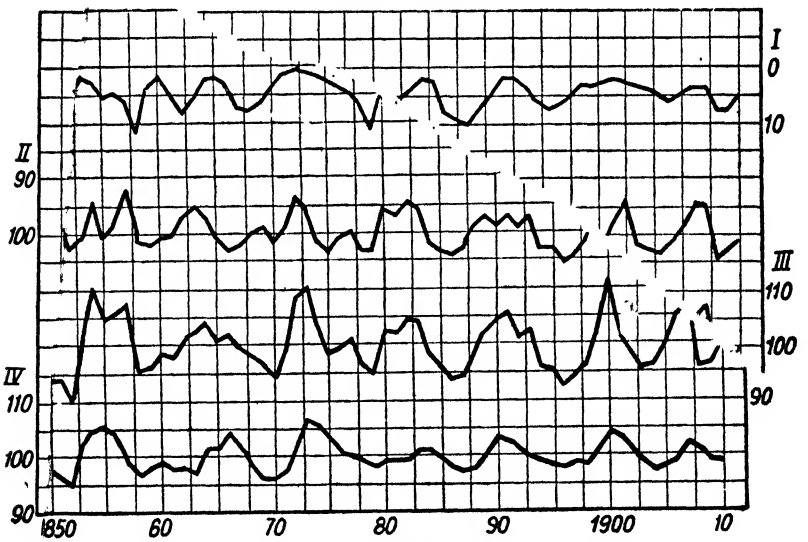
[1] Keynes, *loc. cit.*, p. 38.

correlation between the movements of the price level and the product wage rates. This appears to bear out the traditional generalization that when prices rise, money wage rates do not rise as fast, so that a fall in real (product) wage rates generally results, and conversely. In the period 1850–1910, the wholesale price level (without eliminating the trend) increased in twenty-seven years, during which product wage rates with trend eliminated fell in twenty-two years, and rose in only five years, during which the money wage rates actually increased faster than the wholesale prices. It is significant, however, to note that of the five years during which money wages increased to a greater extent than wholesale prices, four—viz. 1864, 1866, 1873 and 1907, were peaks of booms followed immediately by recessions.

During the same period, the price level (with trend uncorrected) declined in twenty-nine years, during which product wage rates increased in twenty years and decreased in nine years, in which money wage rates actually fell faster than the wholesale prices.

CHART I

HOURLY MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES AND THE PERCENTAGE OF UNEMPLOYMENT IN GREAT BRITAIN (1850–1910)



Curve I: Unemployment percentage inverted.
Curve II: Index of product wage rates inverted, and with trend removed.
Curve III: Index of wholesale prices with trend removed.
Curve IV: Index of money wage rates with trend removed.
For data see Statistical Appendix to Chap. III, Table I, pp. 154–5

To the extent that money wage rates moved together with the wholesale prices, the product wage rates also tended, *pro tanto*, to move in the opposite direction with the money wage rates. It appears that Lord Keynes's contention that a change in the general level of money wages tends generally to be associated with a change in real wages in the opposite direction is largely true, if we are considering the broad sweeps of money and product wage rates. As can be seen from Chart I, the broad wave movements of product wage rates (inverted) and the money wage rates did fit into each other to some extent, particularly in the later part of the period, although the alleged negative correlation did not hold good for a good number of years. In the period 1850–1910, money wage rates, with trend uncorrected, increased in thirty-one years, during which product wage rates with trend eliminated decreased during eighteen years and increased during thirteen years. During the same period money wage rates (with trend uncorrected) fell during seventeen years, during which product wage rates with trend eliminated increased in nine years and decreased in eight years. If we take the period 1880–1910, then we find that money wage rates increased in sixteen years, during which product wage rates with trend eliminated decreased in eleven years and increased in only five years. And in the same period money wage rates decreased in eight years, during which product wages with trend removed increased in six years and fell in only two years. This contrasts with the results obtained by Dr. Dunlop from his investigation into the relation between money wage rates and real wage rates as indicated by the index of money wage rates as a percentage of the index of the cost of living. There he found that in the period from 1880 up to the last war, money wage rates rose during fourteen years, during which real wage rates, corrected for changes in terms of trade and for trend, increased during nine years and fell during five. On the other hand, money wage rates fell in six years, during which real wage rates fell in four years and rose in two.[1]

There appears on the whole to be a positive correlation between the product wage rates and the percentage of unemployment, except during the period 1858–1870. For the rest of the period the broad waves of product wage rates appear to fit into those of the percentage of unemployment to some extent, especially from 1879 onwards. The lack of exact correspondence in turning-points is due to the not easily explicable fact that the turning-points and fluctuations of the trade union unemployment figures did not coincide very closely with those in the wholesale price index, which seems to be more closely correlated with product wage rates than anything else. But on the

[1] Dunlop, *loc. cit.*, pp. 415–18.

whole it is perhaps still permissible to say that product wage rates tend to fall at high level of employment and to rise at low level of employment.

It must be borne in mind, however, that the wholesale price index employed here, being taken from Layton's *Introduction to the Study of Prices*, consists of, from 1850 to 1860, Jevons's index, and, from 1860 onwards, Sauerbeck's. These indices include exclusively the prices of foodstuff and the prices of raw materials, which latter are known to fluctuate much more than the prices of finished manufactured goods. They might not therefore be representative of the price level of the current products of labour as a whole. Furthermore a number of items of food and materials included in these indices are chiefly imported goods—e.g. wheat, cotton, etc.—and their prices are chiefly determined by the international market and production conditions abroad. The evidence of this chart cannot therefore be regarded as decisive. But one thing which it does tell us definitely is that the economists in the past have not blindly accepted Marshall's generalization with gross disregard of actual statistics, as Lord Keynes suspected;[1] for Marshall's generalization that prices generally rise or fall faster than money wages was certainly well supported by the available, though not quite satisfactory, statistics in this period.

The statistics in Great Britain for the period after the last war serve only further to confirm the evidence of the pre-war statistics. Chart II shows the relation between money wage rates, wholesale prices, product wage rates (the ratio between the first two × 100) and the percentages of unemployment. The index of money wages is Professor Bowley's. The index of wholesale prices is that computed by the Board of Trade, which is superior to the wholesale price index used in our previous chart in that the Board of Trade index includes some quotations of manufactured articles, although food and raw materials are still predominant and fully finished products are still excluded because of the practical difficulty of securing quotations for finished articles which are precisely comparable in quality and character over a period of years. The figures for unemployment are those published by the Ministry of Labour, which are also more reliable than the trade unions' figures used in the previous chart.

It is evident from this chart that there is a marked inverse correlation between the wholesale prices and the product wage rates. With the exception of only three years, wholesale prices had always fluctuated more than money wages, which had been remarkably stable since 1923, so that a change in prices was generally associated with a change in product wage rates in the opposite direction. It is interesting to note that the three exceptional years, 1922, 1923 and

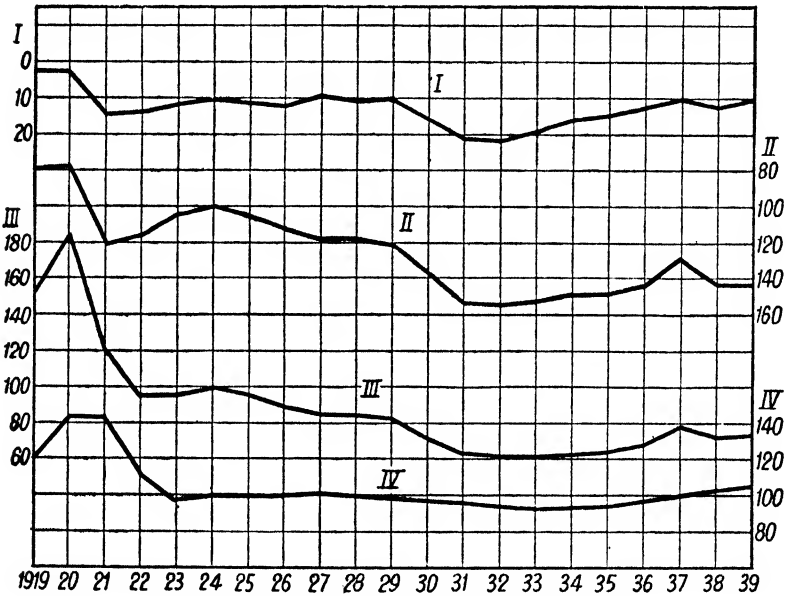
[1] *Vide supra*, p. 43.

1933, during which money wage rates actually fell more than wholesale prices are all the beginnings of recoveries.

There is also a remarkably close positive correlation between the product wage rates and the percentage of unemployment. That is to say, in general when the percentage of unemployment increased (or

CHART II

HOURLY MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES AND THE PERCENTAGE OF UNEMPLOYMENT IN GREAT BRITAIN (1919–39)



Curve I: Unemployment percentage inverted.
Curve II: Index of product wage rates inverted.
Curve III: Index of wholesale prices.
Curve IV: Index of money wage rates.

For data see Statistical Appendix to Chapter III, Table II, p. 156.

the level of employment fell), product wage rates also increased, and when the percentage of unemployment decreased (or the level of employment rose), the product wage rates also decreased. The year 1927 appears to be an obvious exception, but this anomaly is probably due, to some extent, to the breaking up of the general strike in the previous year, so that unemployment showed a sudden decrease, although product wage rates had increased.

Thus the statistics of Great Britain, both before the last war and after, appear on the whole to bear out the traditional belief that real

(product) wages tend to fall as employment and business activity rise and to rise as employment and activity fall, and that money wages tend to lag behind the rise or fall of prices.

The statistics of Great Britain, however, are open to two objections from our point of view. First, as we have mentioned above, Great Britain being highly dependent on international trades, her wholesale prices and product wages as measured by the ratio between the index of money wage rates and that of wholesale prices are particularly liable to be influenced by changes in the terms of international trade. Secondly, the indices of money wages, particularly Professor Bowley's index for post-war years, are indices of weekly wages. Therefore when there are changes in the number of hours worked per week, these indices might not represent exactly the movements of the wage rates per unit of labour-time. These objections can be largely overcome when we turn to American statistics. For the United States are far less dependent on foreign trade than Great Britain for imports of both raw materials and manufactured products. Indeed it may be considered with justice as approximately a closed system more than any other advanced country. Its price level and product wage rates are therefore far less influenced by changes in the terms of international trade. Moreover, for the United States, statistics of hourly wages, which represent more closely the wage rate per unit of labour, are available for a considerable period for manufacturing, mining and other industries. In addition, the American wholesale price index, as compiled by the Bureau of Labour Statistics, includes far more quotations of finished manufactured products and thus measures more adequately the price level of the current products of labour as a whole.

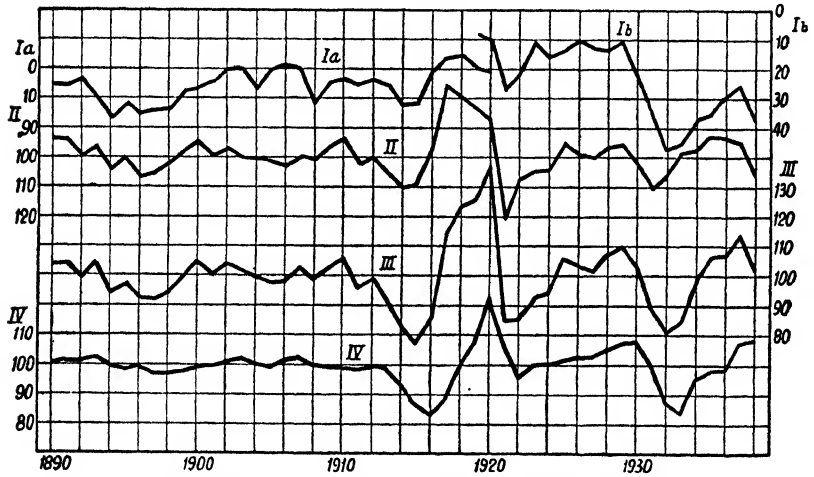
In Chart III, we compare the indices of wholesale prices, hourly money wages and product wage rates (inverted) with the estimated percentages of unemployment (also inverted) in the United States from 1890 to 1939. The percentages of unemployment from 1890 to 1920 are Professor Paul Douglas's estimates of the percentages unemployed of the estimated normal labour supplies of industry as a whole for the different years.[1] The percentage becomes negative when the number employed exceeds his estimated normal supply of labour for the same year. The second section from 1919 to 1939 is the percentages unemployed of the estimated numbers of wage-earners attached to the manufacturing, railroads, mining, and construction industries, computed by Dr. Spurgeon Bell of the Brookings Institute.[2] The index of wholesale prices employed is that of the Bureau of Labour Statistics. The index of money wages consists, from 1890 to 1926, of Professor Douglas's index of hourly wages for

[1] Reproduced from Douglas, *Real Wages in the United States*, p. 547.
[2] Spurgeon Bell, *Productivity, Wages, and National Income*. p. 21.

industry as a whole;[1] from 1926 to 1938 it is computed by combining the index of hourly wages for manufacturing, mining, steam railroads, and construction industries (representing about ninety per cent of the industrial employment) as compiled by Dr. Spurgeon Bell,[2] with the monthly wages of farm labourers as published by the Department of Agriculture, with weights in approximate proportion of their wage bills in 1929. As is the case with British experience, there is also a very close inverse correlation between the wholesale prices and

CHART III

HOURLY MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES AND THE PERCENTAGE OF UNEMPLOYMENT IN THE U.S.A. (1890–1938)



Curves I*a* and I*b*: Unemployment percentage inverted.
Curve II: Index of product wage rates inverted and with trend removed.
Curve III: Index of wholesale prices with trend removed.
Curve IV: Index of hourly money wages with trend removed.
For data see Statistical Appendix to Chap. III, Table III, pp. 157–8.

product wage rates, which again reinforces the traditional generalization that money wages tend to lag behind the fluctuations of prices so that a rise in prices is generally associated with a fall in real (product) wages, and conversely. During the first thirty years of this period, there was a strong trend for wholesale prices to rise. With the secular trend eliminated, wholesale prices increased, between 1890 and 1938, in twenty-eight years, during which the product wage rates also with trend removed decreased in twenty-two years and increased

[1] P. Douglas, *op. cit.*, p. 205.
[2] *Op. cit.*, p. 234.

in only six years, in which money wages rose faster than wholesale prices. During the same period (1890–1938), wholesale prices (corrected for trend) decreased in twenty years, during which product wage rates (with trend eliminated) rose in seventeen years and fell in only three years, in which money wages fell to a greater extent than wholesale prices.

There is also a noticeable degree of positive correlation between the percentages of unemployment and the product wage rates on the whole, as with the British statistics. The only sustained period during which such correlation is not discernible is from 1900 to 1907. During these seven years, however, the wholesale prices also displayed no correlation with Professor Douglas's estimates of unemployment. For the rest of the period it appears to be justified to say that, generally speaking, product wage rates tend to fall as the level of employment rises, and to rise as the level of employment falls.

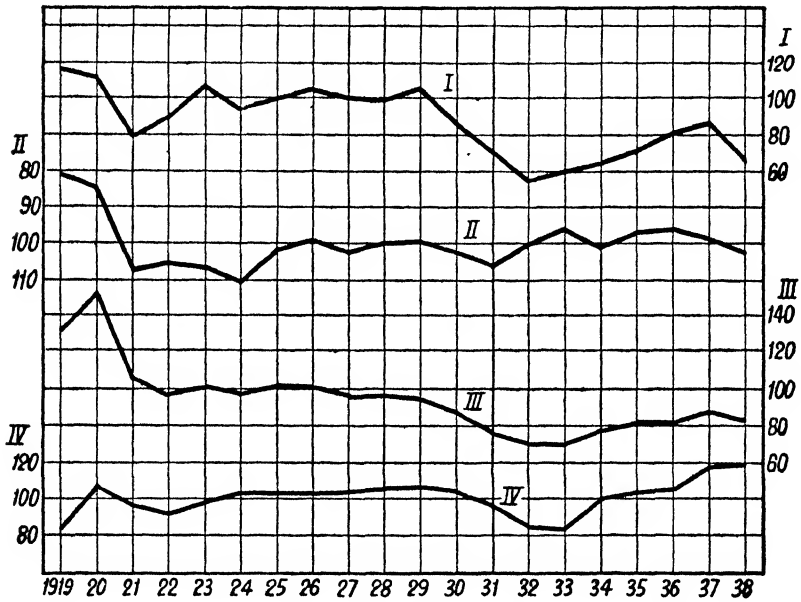
The correlation between money wage rates and product wage rates (inverted) is less close. This is partly because money wage rates sometimes continue to rise while wholesale prices or employment already began to fall and to fall while wholesale prices or employment already began to rise, and partly because money wage rates sometimes overtook the fall or rise in wholesale prices. During the whole period 1890–1938, money wage rates, with its strong rising trend eliminated, increased in twenty-seven years, during which product wage rates corrected for trend decreased in fifteen years and increased in twelve years. Of the twelve years of increased money wages with increased product wages, six saw the money wages increase while wholesale prices began to fall off; six witnessed money wages overtake the rise in wholesale prices. During the same period 1890–1938, money wage rates with trend removed decreased in eighteen years, during which product wage rates increased in nine years and decreased in nine years. Of the nine years of decreased money wages with decreased product wages, six saw continued declines in money wages while wholesale prices already began to rise, and three experienced decreases in money wages greater than the decline in wholesale prices.

It appears therefore that both for the United States and Great Britain, the traditional belief that in the short period prices generally rise or fall faster than wages and that real wages (in the sense of product wages) in industry as a whole generally move in the opposite direction with the short-period fluctuations of the level of employment holds good on the whole up to very recent years, although, as we have seen in the previous chapter, there is no theoretical necessity, based on such *a priori* considerations as the stability conditions, for the rate of product wages to behave in this particular manner in a world where imperfect competition is a more or less prevalent phenomenon.

We shall next examine how far the traditional notion of inverse correlation between product wage rates and employment or output applies for the three principal sections of the industrial system—viz. manufacturing and mining industries and agriculture, taken separately. In Chart IV we compare together the indices of man-hour

CHART IV

HOURLY MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES OF FINISHED PRODUCTS AND EMPLOYMENT IN MANUFACTURING INDUSTRIES IN THE U.S.A.



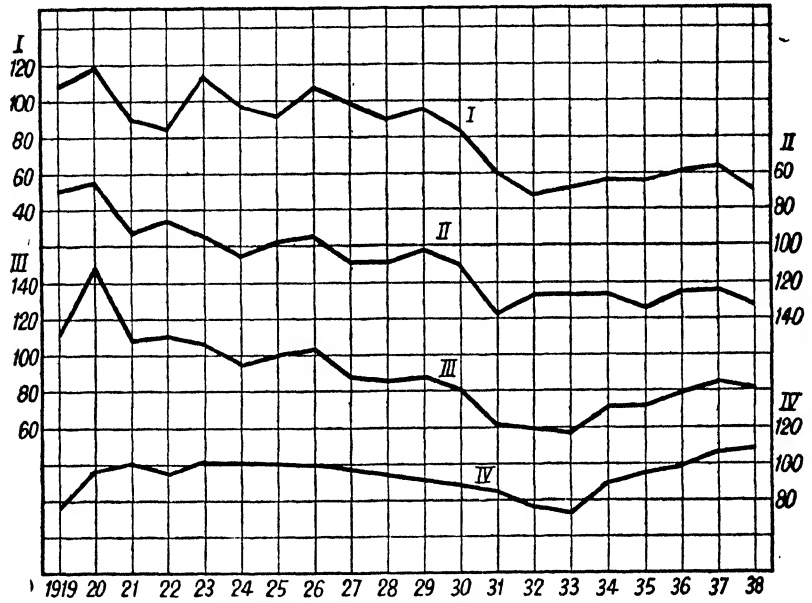
Curve I: Index of man-hour employment.
Curve II: Index of product wage rates with trend eliminated and inverted.
Curve III: Index of wholesale prices of finished manufactured products.
Curve IV: Index of hourly money wages.
For data see Statistical Appendix to Chap. III, Table IV, p. 159.

employment, wholesale prices of finished manufactured products, hourly money wages and product wage rates in the manufacturing industries for the period 1919–38. There is a strong trend in the product wage rates, which more than doubled during these twenty years. In our present chart, however, the secular trend in product wages is removed by taking the percentage deviations of the actual series from the linear trend calculated by the least square method. It is striking that the product wage rates in the manufacturing industries

in terms of finished manufactured goods is much more stable than the product wage rates in industry as a whole in terms of all commodities. This is no doubt related to the fact that prices of finished manufactured goods fluctuate less than the wholesale prices of all commodities. From 1919 to 1931, a vague negative correlation was

CHART V

HOURLY MONEY AND PRODUCT WAGE RATES, VALUE PER UNIT OF OUTPUT, AND MAN-HOUR EMPLOYMENT IN MINING INDUSTRIES IN THE U.S.A. (1919–38)



Curve I: Index of man-hour employment.
Curve II: Index of product wage rates inverted.
Curve III: Index of value per unit of output.
Curve IV: Index of hourly money wages.
For data see Statistical Appendix to Chap. III, Table V, p. 160.

still discernible between the level of employment and product wages, but after 1931 there is hardly any correlation. It is significant to note, however, that the irregular movements in product wages particularly after 1931 were generally associated with sharp jumps in money wages—e.g. the sharp decline in money wages between 1931 and 1932 seems to be the active cause of the fall in product wages, although employment continued to fall, the spectacular jump in money wages in 1934 brought about a sudden rise in product wages, although employment was rising, and the sharp rise in 1937 also turned the

product wages from falling to rising, although employment continued to climb. The correlation between wholesale prices of finished products and product wages is also not very clear, for money wages often fluctuated to a greater extent than prices. As a consequence of this, a change in money wages has more often than not been associated with a change in product wages in the same direction. During this period, money wages in manufacturing industries increased in eleven years, out of which product wages with trend eliminated increased in seven years and decreased in only four years. And out of the seven years, during which money wages in manufacturing industries decreased, product wages corrected for trend decreased in four years and rose in three.

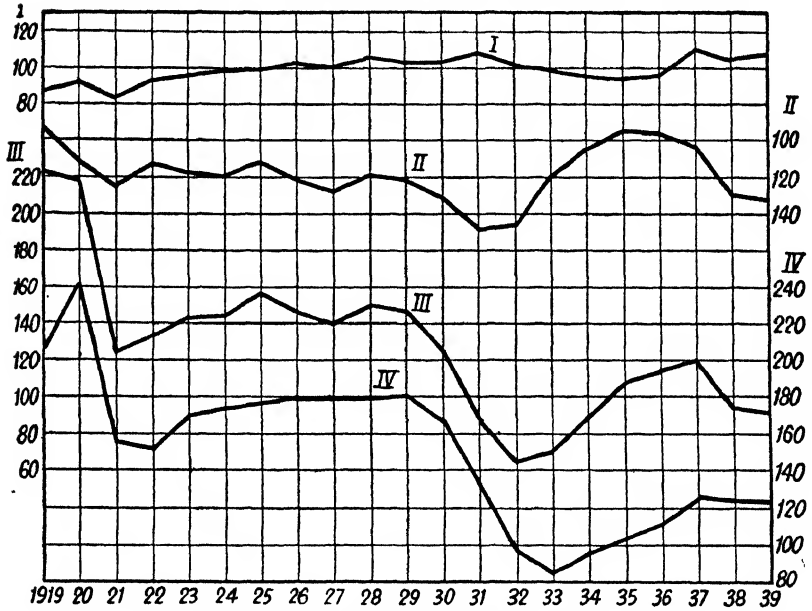
The situation in mining industries (including petroleum and natural gas industries as well as metal and non-metal), 1919–38, is depicted in the next chart. Curve I is the index of hourly money wages in mining industries, Curve II the index of the money value per unit of output at the source of production for mining industries, Curve III the index of product wages (the ratio between the first two series multiplied by 100) inverted, and Curve IV the index of man-hour employment in mining industries. It can be observed that there is a quite close negative correlation between the value per unit of product and product wages, implying that prices fluctuated on the whole more than money wages, except at the bottom of the great depression (1932–34). A vague negative correlation can also be recognized between the product wage rates and man-hour employment, though it is much less definite; for in four years during this period product wages moved in the same direction as the level of employment. Money wage rates had been relatively stable and declined steadily since 1923 until 1933. The sharp cut in money wages between 1931 and 1932, however, succeeded in bringing about a fall in product wages, though employment and output still continued to fall, as is also the case with industry as a whole and the manufacturing industries.

Chart VI compares the indices of money wage rates (monthly) of farm labourers, prices of farm products received by farmers, product wage rates (computed from the first two indices) and physical volume of farm production (crops, livestock and product) from 1919 to 1939. Although the movements of product wages in agriculture fit into those in farm prices to a certain extent, there is, contrary to the expectation that might arise from the belief that the law of diminishing returns is particularly operative in agriculture, hardly any correlation at all between agricultural product wages and farm output. This is partly because even in the United States there are a large number of peasant farms operated chiefly by family labour, the output of which is

entirely independent of the cost of hired labour and very insensitive to prices. Partly it is because agricultural output in the short period is to a large extent dependent on the weather conditions and beyond the control of the farm operators, and partly because of the long natural time-lag or gestation period necessary between the decisions to vary supplies and the actual appearance of the changed volume

CHART VI

PRODUCT AND MONEY WAGE RATES, FARM PRICES AND FARM PRODUCTION IN THE UNITED STATES AGRICULTURE (1919–39)



Curve I: Index of farm production.
Curve II: Index of product wage rates inverted.
Curve III : Index of farm prices.
Curve IV: Index of monthly wages of farm labourers.
For data see Statistical Appendix to Chap. III, Table VI, p. 161.

on the market. Thus in the short period prices of agricultural products are largely determined by the monetary demand conditions, to a considerable extent independently of concurrent prime costs of production, not to say the cost of hired labour, which is after all a small proportion of even the prime costs particularly in small farms. The prolonged decline and low level of output after 1933 in spite of rapid rise in prices is probably the effect of the government restriction policy under the Agricultural Adjustment Act. Both farm

prices and wages fluctuated far more than in manufacturing and mining industries, but changes in money wages were more often than not associated with changes in product wages in the same direction.

The results of this chapter may be summarized as follows—

1. In the United States as well as in Great Britain, product wage rates in the system as a whole, as measured by the ratio between the index of the average money wage rate and that of the general wholesale prices, with secular trend eliminated are closely inversely correlated with wholesale prices corrected for trend.

2. In the United States as well as in Great Britain, product wage rates in the system as a whole, as measured in the above manner, appear to be on the whole positively correlated with the percentage of unemployment.

3. Rises in the average money wage rates were more often associated with decreases than with increases in product wage rates measured in this way, both in the United States and Great Britain. And falls in the average money wage rates were more often associated with increases rather than with decreases in product wage rates in the system as a whole. But there were a number of instances where a sharp change in money wages brought about a change in product wages in the same direction.

4. Product wage rates in the manufacturing industries in the United States, measured in terms of the finished manufactured products, however, were relatively stable during the period 1919–38, in spite of wide fluctuations in employment, prices, and money wages. There is a vague negative correlation between product wage rates and man-hour employment up to 1931, after which year correlation hardly exists. Contrary to the case with product wage rates in the system as a whole, as measured by the ratio between the index of average wage rates and that of general wholesale prices, changes in money wage rates in manufacturing industries were more often than not associated with changes in product wages, in terms of finished manufactured products, in the same direction; particularly the sharp jumps in money wages in the thirties always brought about a change in product wages in the same direction.

5. Product wages in mining industries, in terms of mineral products valued at source of production, show a negative correlation with man-hour employment there, but not very close.

6. There is no recognizable correlation between agricultural output and product wage rates of farm labourers in terms of agricultural products at farm prices.

CHAPTER IV

FACTORS GOVERNING THE RATE OF PRODUCT WAGES IN MANUFACTURING INDUSTRIES

In this chapter we shall attempt to analyse more fully the fluctuations of the product wage rates in manufacturing industries in particular, and to assess the relative importance of the various factors affecting the product wages.

From what we have observed in Chapter I, it is clear that if we assume as a starting-point of our argument that entrepreneurs fix their prices at such levels as to equalize short-period marginal revenues and marginal costs, the rate of product wage in any industry may be said to be determined by the following factors: (1) the marginal gross physical productivity of labour, (2) the degree of monopsony, if any, in the labour market, (3) the marginal costs of materials and other co-operating prime factors, and (4) the degree of imperfection of competition, or the average elasticity of the individual demand curves for the products of different entrepreneurs, taking into consideration both the imperfection of the market and the individual producers' conjectures about the reactions of their competitors to their own policies. The first two factors determine the marginal labour costs relative to the wage rate. The third factor together with the two previous ones determines the relation between marginal prime costs and money wage rate. The fourth determines the relation, or the gap, between marginal prime costs and product prices.

There is, nowadays, an increasing belief among economists that for the manufacturing industries the marginal prime costs functions are probably mostly linear and deviate little from the average prime costs until the bottle-necks of the plant capacity is approached. This belief is supported by what statistical evidence there is available in this field. For instance, the various recent statistical investigations of the cost-output functions in several manufacturing industries in the United States as well as in Germany all appear to agree on the linearity of the cost-output functions. These empirical inquiries may be distinguished into three different types—

1. One group of studies attempts to derive the cost-output functions under a given state of technique and constant factor prices from the cost and output records in the past by eliminating with the help of statistical technique of varying refinements, the effects of factors other than variations in the rate of output, presumed to influence costs. The most famous inquiries of this type are Kurt

Ehrke's investigation of the cement industry in Germany,[1] Professor Theodore O. Yntema's study of the United States Steel Corporation,[2] Joel Dean's studies of firms in the furniture, leather belting, and hosiery industries,[3] and also the study of the cost function of the United States Steel Corporation by Kathryn H. Wylie and Mordecai Ezekiel.[4] All these statistical derivations of cost functions have yielded very similar results—viz. the conclusion that the total cost output function of the industry studied may be represented by a linear regression line, which implies that marginal cost per extra unit of output is constant.

2. Another type of studies of the cost functions are estimates by engineers and accountants, presented as cost functions to be expected in the near future. These inquiries differ from those of the first group in that they utilize cost estimates rather than the direct accounting experience of a firm. Output is characteristically measured in terms of per cent of plant capacity. A number of such studies have been made in Germany by E. Schmalerbach,[5] Reinhard Hildebrandt,[6] Herbert Peiser[7] and others. And they invariably arrive at a linear function. It is quite natural that Reinhard Hildebrandt, for example, should regard this relationship as typical.[8]

3. There is yet another type of estimates of the relationship between output and costs—viz. the recently developed accounting device, now commonly used in the United States, known as the Budgeting Break-Even Charts. Such charts contain estimates of the way in which, assuming a given set of factor prices costs are expected to vary with sales at constant prices and hence with output. The X-axis shows output (usually measured in percentage of capacity); the Y-axis is labelled in dollars. A line indicating total costs and another indicating total revenue at various rates of output are plotted according to this system of co-ordinates. This kind of chart takes its name from the fact that the lines intersect where total costs equal

[1] *Die Überzeugung in der Zementindustrie von* 1858–1913 (Gustav Fischer, Jena, 1933).

[2] *United States Steel Corporation T.N.E.C. Papers*, comprising the Pamphlets and Charts submitted by the United States Steel Corporation to the Temporary National Economic Committee (United States Steel Corporation, 1940, Vol. I, pp. 223–301).

[3] *Statistical Determination of Costs, with Special Reference to Marginal Costs* (University of Chicago Press, 1936). Also *Statistical Cost Functions of a Hosiery Mill*, "Studies in Business Administration," Vol. II, No. 4, and *The Relation of Cost to Output for a Leather Belt Shop*, National Bureau of Economic Research, Technical Paper, No. 2.

[4] "The Cost Curve for Steel Production," *Journal of Political Economy*, December, 1940, pp. 777–821.

[5] *Selbstkostenrechnung und Preispolitik* (Leipzig, 1934).

[6] "Geschäftspolitik auf Mathematischer Grundlage," *Technik und Wirtschaft*, XXIV, (1931).

[7] *Der Einfluss des Beschäftigungsgrades auf die industrielle Kostenentwicklung* (Gesellschaft für Betriebsforschung, Berlin, 1929).

[8] *Loc. cit.*, p. 127.

revenue, that is, the "break-even" point of plant utilization. One set of costs and revenue lines must be drawn for each level of wage rates, material prices, and realized prices from products for sale. Such charts are used by business executives in making decisions with regard to output and price policies.

The interesting feature of the break-even charts is that almost all break-even charts appear with linear total cost-output relationship. This unanimous presumption of linearity is somewhat surprising in that the estimated cost functions cover the range of output from zero to full capacity. It is difficult to tell whether this is simply a matter of projecting the relationship expected in the normal range of output fluctuation to upper and lower extremes, or a result of careful calculation. It may indeed be criticized that the linearity of cost functions in budgeting break-even charts are simply the result of the way in which they are constructed. As a critic points out, "the conventional break-even chart is based on the assumption that all variable expense has a straight-line relationship or is in direct proportion to activity, and that all the items classed as fixed expense remain as constant fixed expense for the whole range of plant activity."[1] It is true that arbitrary presumption enters to a certain extent into the construction of these charts, but the almost universal presumption that the cost function is linear must be regarded as the reflection of the fact that for all practical purposes, such an assumption is adequate enough for the normal range of plant activity. If decisions are made on the basis of a linear cost function—i.e. constant prime costs—then this fact alone is relevant for the explanation of their price and output policies, even though the actual shapes of the cost functions may slightly deviate from a straight line.

The direct inquiry, conducted by Mr. C. C. Saxton, of a number of manufacturing firms in Great Britain by means of questionnaires and interviews also leads to the conclusion that "in general, for all producers of manufactured products it seems that marginal cost is fairly constant over the range of output about which it is normally expected to use the given equipment on hand at the beginning of the production period."[2] The famous Oxford inquiry on price policy by Messrs. Hall and Hitch also suggests that entrepreneurs generally determine their price on the basis of prime cost per unit of output and make no distinction between average prime cost and marginal prime cost,[3] which indicates that they regard the average prime costs as a sufficiently adequate approximation to the marginal costs.

The prevalence of the phenomenon of constant marginal costs

[1] H. R. Mallory, "A Silk Mill," *Mechanical Engineering*, August, 1933.
[2] *The Economics of Price Determination*, p. 100.
[3] "Price Theory and Business Behaviour," *Oxford Economic Papers*, May, 1939.

in manufacturing industries may be accounted for by the following facts—

1. As suggested by Mr. Lloyd G. Reynold,[1] "fixed factors" in manufacturing, which used to be supposed as indivisible are in fact probably highly divisible. For instance, many manufacturing plants are made up of batteries of similar machines, each of which can be operated independently. Consequently, if the machines are of more or less equal efficiency, the setting in motion of successive units need not involve any increase or decrease of the productivity of labour and of the marginal costs. Even when the plant consists of a single producing unit which must be operated as a whole, it may be operated for only a part of each week or month. Again there would be need for departure from constant productivity up to the one-shift normal hour operation. When overtime or more than one shift are necessary, it may be granted that overtime work or night shift is usually less efficient and that the cost per man-hour may be higher. But this only means that the marginal cost will perhaps rise discontinuously to a higher level, but remain horizontal up to the limit of the second shift.

2. The degree of monopsony in labour market exercised by a single firm is probably insignificant with the increasing unionization and collective fixing of wages by trades, at least until it becomes necessary for the firm to bid away labour from other firms or industries. Such necessity is perhaps of no practical importance for the American manufacturing industries during the inter-war period except perhaps during the inflationary boom after the last war; for as we have seen in the previous chapter, the man-hour employment during the two decades after 1919 had never again attained the level reached in that year,[2] and the number of wage-earners employed in manufacturing industries in 1919 was not exceeded even at the height of the boom in 1929,[3] although the working population had been steadily increasing.

3. The physical amount of materials per unit of output is perhaps more or less technically fixed until there is a severe stress on the plant capacity. Consequently material costs normally change only in so far as material prices change. The degree of monopsony exercised by most individual firms in material markets is perhaps also insignificant. It is true that large-scale purchasing is frequently favoured with better concessions. But price or other concessions are not likely to be a continuous function of the size of order, but usually occur

[1] "Relation between Wage Rates, Costs and Prices," *American Economic Review*, Supplement, March, 1942.

[2] *Vide infra*, p. 159, Table IV, Col. V, and also Chart IV.

[3] *Vide* Solomon Fabricant, *Employment in Manufacturing*, 1899–1939, p. 212. The 1919 mark was only surpassed in 1937.

discontinuously at big intervals. Therefore the advantage of large-scale buying may discriminate in favour of large firms as against small firms, but it need not bring any extra advantage to a given firm beyond what it already enjoys, when it varies its output, and therefore the amount of materials it purchases, round its normal level, unless very radical changes in the scale of production is contemplated. Thus marginal material costs may be regarded as fairly constant for each individual firm.

4. As regards the user cost or prime depreciation, it is true that there is a strong *a priori* reason why prime depreciation of fixed equipment should be rising as output expands. For, as Lord Keynes pointed out, not only will the physical deterioration of equipment proceed at an increasing rate with increasing intensity of utilization, but theoretically speaking, the estimate of the loss in value of fixed equipment through being used is based on the estimated present value of the equipment—i.e. the sum total of the discounted values of all future uses. If the present level of plant activity is high, so that the entrepreneur, being consequently more optimistic about the future prospect, puts a higher value on the existing equipment, then the estimate of the loss in value through an increase in intensity of utilization would increase, even if the physical rate of depreciation remains the same. All this may be a very convincing reason for supposing that, theoretically speaking, prime depreciation would increase when the rate of output increases. But it is very doubtful whether actual business executives do treat the depreciation of their fixed equipments in the theoretically rational manner. For the assessment of the exact rate of prime depreciation apart from the deterioration and obsolescence due to mere passage of time and the frequent revision of the prospective value of the plant are very difficult and troublesome procedures, and it is generally not regarded worth while to go to all this trouble. In practice, it is found that the business men generally follow a conventional method of depreciating durable equipments which takes no account of the current degree of utilization.[1] A "safety" margin is usually provided in the rate of depreciation to cover the risk of abnormal wear and tear and the risk of other unexpected loss in capital value. Thus, whatever it may be in theory, in practice depreciation costs are generally not treated by business executives as an item of variable or prime cost and therefore do not affect the constancy of marginal costs.

Since in reality marginal costs do not deviate from average prime costs to any appreciable extent in the manufacturing industries, so that business men generally regard it as adequate enough to decide

[1] Cf. Saxton, *op. cit.*, p. 79, and also *Cost Behaviour and Price Policy*, National Bureau of Economic Research, New York, 1943, pp. 65–6.

their price policies on the basis of average prime costs, we may, without much danger of over-simplification, reduce the factors affecting the rate of product wages in manufacturing industries to three: (1) the average gross physical productivity of labour, (2) the raw material prices relative to money wage rates, and (3) the average degree of imperfection of competition. Since marginal costs normally do not deviate much from the average prime costs and the business executives generally base their decisions on price policies on average prime costs as a ready approximation to marginal costs, the degree of imperfection of competition (or monopoly) as defined by Dr. A. P. Lerner[1]—i.e. price minus marginal cost divided by price, which, assuming that marginal cost is always equated to marginal revenue, is identical with the inverse of the elasticity of the expected individual demand curve—is then equal to the ratio of the total gross value of the product minus the total prime cost to the total gross value—viz. the percentage gross profit margin. For the manufacturing industries as a whole, the ratio between the aggregate of the gross proceeds of all the constitutent industries minus the aggregate prime costs and the aggregate proceeds would give us the average of the percentage gross profit margins in the different industries or firms, weighted according to the magnitudes of the gross value of products in those industries. As different industries are likely to have different gross profit margins or degrees of imperfection of competition, the average gross profit margin for manufacturing industries as a whole might therefore be influenced not only by changes in the profit margins in the various industries, but also by changes in the relative magnitudes of the gross value of products of the different industries. We shall deal with the significance of the influence of such shift of weights upon the average profit margin in manufacturing industries later on.[2]

When the output of an industry reached a certain point in relation to the capacity—i.e. when the bottle-neck of production is reached—however, marginal cost would eventually rise steeply and ahead of the average prime costs. If then the entrepreneurs, realizing how the difference between marginal costs and average prime costs, begin to set their prices on the basis of marginal costs, the percentage gross profit margin would then not merely reflect the degree of imperfection of competition but also the difference between marginal costs and average prime costs. In the light of the data that we shall present shortly, however, the bottle-neck factor does not appear to have had any real importance in the American manufacturing industries as a

[1] A. P. Lerner, "The Concept of Monopoly and the Measurement of Monopoly Power," *Review of Economic Studies*, June, 1934.

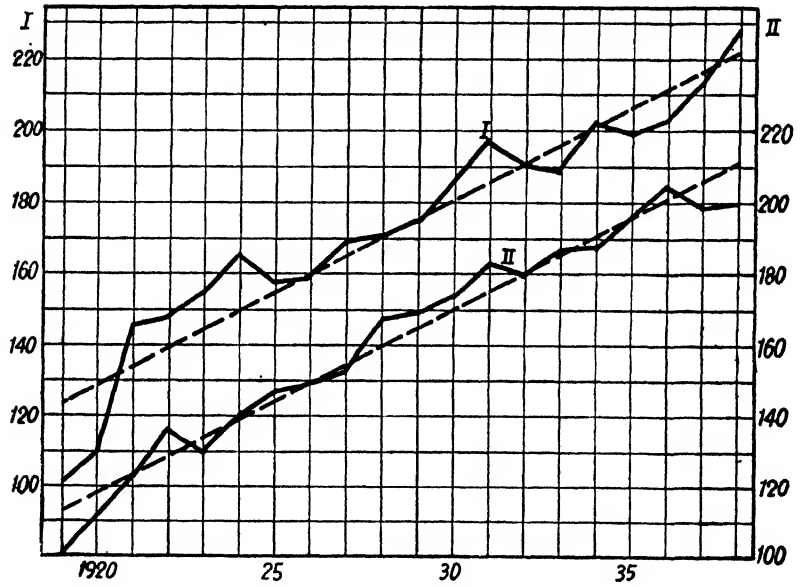
[2] *Vide infra*, Chap. VI, pp. 87–9.

whole during the inter-war period, except perhaps during the inflationary boom of 1919–20.

In the following chart (Chart VII) we shall first compare the product wage rate with the gross physical man-hour productivity of labour in manufacturing industries during the period 1919–28. It can be seen at a glance that both series rose rapidly during the two

CHART VII

PRODUCT WAGE RATES AND MAN-HOUR PRODUCTIVITY IN MANUFACTURING INDUSTRIES IN THE U.S.A. (1919–38)



Curve I: Index of product wage rates.
Curve II: Index of man-hour productivity.
For data see Statistical Appendix to Chap. IV, Table VII, p. 162.

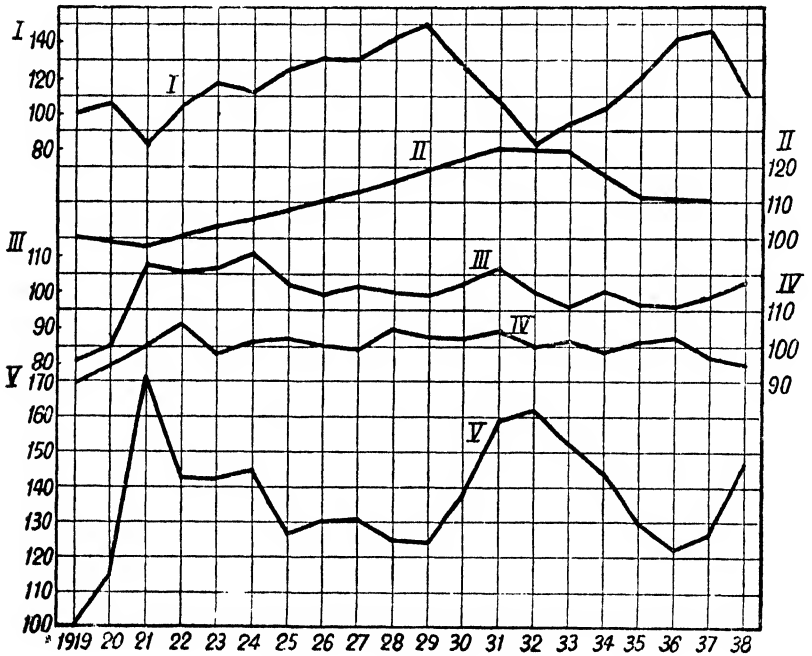
decades after the last war, and on the whole rose at approximately the same rate. If we fit a linear trend to each of these two series by the least square method, we shall find that the slopes of the trends are almost exactly the same; the formula for the trend of product wage rate being $-y = 5{\cdot}162x + 123{\cdot}47$, and that of man-hour productivity being $-y = 5{\cdot}188x + 112{\cdot}07$, both with the year 1919 as origin.

The fluctuations of these two series round the respective trends, however, do not appear to be correlated at all. The situation is shown

in Chart VIII, where we compare together the product wage rate, man-hour productivity (both with trend eliminated), the ratio of money wage rates to raw material prices (also with trend removed), and the percentage gross profit margin of manufacturing industries

CHART VIII

PRODUCT WAGE RATES, MAN-HOUR PRODUCTIVITY, RATIO OF MONEY WAGE RATES TO RAW MATERIAL PRICES, AND GROSS PROFIT MARGIN IN MANUFACTURING INDUSTRIES IN THE U.S.A. (1919–38)



Curve I: Index of output.
Curve II: Index of gross profit margins.
Curve III: Index of product wage rates with trend eliminated.
Curve IV: Index of man-hour productivity with trend eliminated.
Curve V: Index of the ratio of money wage rates to raw material prices with trend eliminated.

For data see Statistical Appendix to Chap. IV, Table VIII, p. 163.

as a whole. The index of the ratio of average money wage rate to raw material prices is obtained by dividing the index of the average hourly earning of wage-earners in manufacturing industries with the Bureau of Labour Statistics index of wholesale prices of raw materials. This ratio shows considerable rising trend as well as enormous

fluctuations. We shall remove its upward trend by dividing this series with a trend series consisting of 100·0, 105·2, 110·4, 115·6 . . . the slope of this trend being deliberately taken from that of the index of man-hour productivity (and incidentally being also the same as the slope of the trend of the index of product wage rate). The rationale of this operation is that if the money wage rate has increased relatively to raw material prices in the same proportion as the man-hour productivity has increased—i.e. if the raw material cost has fallen in the same proportion as the unit wage cost relatively to wage rates—average prime costs in the manufacturing industries taken as an integrated whole would have fallen relatively to the money wage rates in the same proportion as man-hour productivity has increased; and given the profit margins, this would result in a fall in prices relative to wage rates—i.e. a rise in product wage rates—in the same proportion. Thus only when the ratio of money wages to raw material prices deviates from man-hour productivity will it cause the ratio of wage rates to average prime costs and, assuming profit margins to be equal, the rate of product wages to diverge from the trend of man-hour productivity, which we have already found to be practically the same as the trend in the rate of product wages itself. As can be seen from the diagram, this method removes more or less completely the secular trend in the ratio of money wage rate to raw material prices, which implies that the trend in the ratio of money wage rate to raw material prices corresponds more or less with that of man-hour productivity and also with that of product wage rate.

The figures of the percentage gross profit margins, however, can only be reliably obtained for odd years from the data of the census of manufactures. The figures here employed are those calculated by Dr. Kalecki from the census data by subtracting total wage bill plus costs of materials, fuel, etc., plus costs of contract work given out and plus costs of work and shop supplies from the total gross value of product and then dividing the residue—viz. net profit plus overheads—with the total gross value of products.[1]

It can be readily observed from the chart that the fluctuations of man-hour productivity bear no definite correlation with fluctuations of product wage rate. Nor do they appear to be correlated in any definite way with the variations in the level of output. In any case, the fluctuations of man-hour productivity had been on the whole small. With the exception of 1919 it never deviated more than six per cent from the trend in either direction. It appears, therefore, that these fluctuations of the productivity of labour round the trend were mainly due to the irregularity of the rate of technical improvements rather than to the existence of any definite law of diminishing, or

[1] *Studies in Economic Dynamics*, pp. 22–3, especially footnote on p. 22.

increasing, returns. This fact seems to lend support to the prevalent belief of the practical business men that prime labour cost can be taken as more or less constant over the normal range of output.

The ratio of money wage rates to raw material prices, however, fluctuated widely during this period, and is negatively correlated with the level of output to a remarkable extent. The fluctuations of this ratio appear also to have an obvious influence on the movements in product wages. For instance, the steep rise of the product wage rate during the depression of 1921 much in excess of the rise in man-hour productivity appears to be chiefly due to the very sharp fall of raw material prices relative to the rate of money wages (or the rise of money wage rate in relation to raw material prices); for the percentage gross profit margin declined but little (only approximately 2·2 per cent) between the boom year of 1919 and the depression year of 1921. Again from 1921 to 1922 the slight fall of product wage rate in spite of the continued rise in productivity was perhaps also to a large extent due to the sharp rise of raw material prices relative to money wages. The drop in product wages from 1924 to 1925, while the man-hour productivity was, if anything, slightly rising, was likewise partly the result of a rise of raw material prices in relation to wages. The rise of product wages from 1929 to 1931 after the break of the boom appears to be entirely the result of the steep decline of raw material prices relative to money wages, for productivity of labour was more or less stable and percentage profit margin continued to be on the rise. The downturn of product wages in the following year in spite of the fact that raw material prices continued to fall slightly relatively to money wages is partly due to the fall in productivity and partly due to the continued rise in profit margin. The upturn in product wages in 1933–34 in spite of falling productivity and rising raw material prices in relation to money wages can only be the consequence of a sudden narrowing of the percentage profit margin in connection with the Wage and Hour Legislation adopted in the mid-summer of 1933 and other New Deal measures, which caused the average hourly money wages and the average wage cost per unit of output in manufacturing industries in 1934 to jump up by 19·3 and 18·4 per cent respectively above the averages for 1933 and the raw material prices to rise by 22 per cent.[1] Whether it is due to mere

[1] Since our figures are all annual averages, and since the National Recovery Act including the Wage and Hour Legislation was put into effect in the course of 1933, these comparisons would not reveal the full extent of the rise in money costs of production brought about by these measures. It has been shown by Professor F. C. Mills in his *Prices in Recession and Recovery* that the average hourly wages increased by 36 per cent between February–March, 1933, and May, 1934, and raw material prices increased by 39 per cent between February, 1933, and May, 1934, whereas the wholesale prices of manufactured goods increased by only 20 per cent during the same period.

rigidity and inertia of prices, or due to a general change in the expectation with regard to the elasticities of demands for individual products, this sharp rise in the money costs of production was evidently not fully compensated by the increase in the wholesale prices of manufactured products, which rose by only 11 per cent between 1933 and 1934. From 1934 to 1938 the movement of the rate of product wages appears to be brought about chiefly by the similar movement in the money wages—raw material prices ratio; for the productivity of labour moved entirely in the opposite direction and the profit margin is probably relatively stable.

Thus we have seen that the fluctuations in the rate of product wages in the manufacturing industries in connection with the fluctuations in employment and output are to a very large extent due to the variation of raw material prices relative to money wages. While in the previous chapter we have found that the movement of product wages around the trend is correlated to a certain extent with that of man-hour employment (the co-efficient of correlation between the rate of product wages and man-hour employment during the period 1919–38, both with trend eliminated, is calculated at $-0{\cdot}45$), it is now found that this negative correlation is chiefly the result of the tendency of raw material prices to rise relatively to money wages when the level of employment and output rises and to fall when the level of output falls. It is not, as used to be believed by economists, due to the operation of the law of diminishing returns in the short period when more labour is applied to a more or less given amount of fixed equipment; for there is no definite correlation, positive or negative, between the productivity of labour and product wages, nor between the productivity and employment or output. The influence of the changes in profit margin, however, cannot be closely ascertained, for no reliable annual index of profit margin is available. But from what we have observed above, we may perhaps be justified in concluding that the cyclical pattern of the rate of product wages during the period 1919–38 is not primarily set by the variations in gross profit margin.

CHAPTER V

PROFIT MARGINS AND THE FLEXIBILITY OF INDUSTRIAL PRICES

It has been shown in the previous chapter that the fluctuation of the rate of product wages in manufacturing industries is to a large extent the result of the variation of raw material prices relatively to money wages. It is evident, therefore, that a change in product wage rate does not necessarily reflect any change in the profitability of production. Nor will the behaviour of product wages during the fluctuations of employment and production throw any particular light on the pricing policies of the actual entrepreneurs in manufacturing industries. On such problems, the behaviour of the profit margin would shed more light.

As we have observed above, the prime cost of a manufacturer is normally more or less constant, so that marginal cost does not deviate from the average prime cost. The gross profit margin is determined by the entrepreneur's percentage addition to the average prime cost in his decision on pricing to cover his overhead costs and profit. It is a problem of great theoretical interest how this percentage margin is decided upon in the mind of the business executive; for this is in fact the fundamental problem of the theory of price determination and the theory of distribution.

We have so far assumed as a convenient starting-point of our argument that this margin is determined in the entrepreneur's mind by a consideration of the elasticity of the expected short-period demand curve confronting him and by the equation of the short-period marginal revenue to the average prime cost, which he takes as a sufficiently adequate approximation to the marginal cost. If we designate the elasticity of the expected demand curve by e, then the marginal revenue, which is equated to unit prime cost, is equal to $\frac{e-1}{e} \times$ price per unit of product. The profit margin, which we have defined as $\frac{\text{price} - \text{unit prime cost}}{\text{price}}$, is therefore equal to $\frac{\text{price} - \frac{e}{e}\,\text{price}}{\text{price}} = \frac{1}{e}$

Thus the profit margin can always be expressed as the inverse of the elasticity of demand. Although the entrepreneur may have no clear idea of the elasticity of the demand curve confronting him, if he is in fact observed to fix his price with a profit margin of certain per cent,

we can always say that the entrepreneur concerned acts as though he believed the elasticity of demand for his product to be the inverse of his profit margin. Such an explanation, however, is an over-simplification. Apart from the fact that it perhaps adds little to our knowledge of how the profit margin is in practice determined, it is also unsatisfactory in theory.

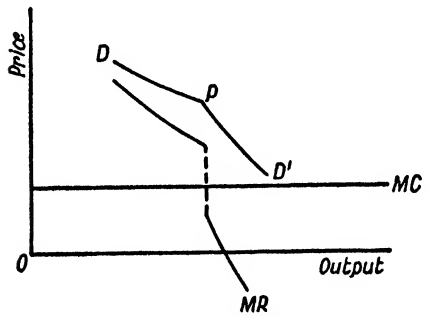
This is so for the following reasons. Firstly, the short-period expected demand curve confronting an individual producer represents the relation between the expected quantity of sales and the price in that given period, for which the entrepreneur concerned plans to fix the selling price, and budget the productive activities.[1] If he sets his price at that level, which equates the marginal revenue derived from this demand curve to the marginal cost during this period, he has succeeded in maximizing his profit, in his expectation, for that period. In practice, however, prices are not always set with a view to maximizing profit in the immediate short period only. For the demand, or the sales possibility, in the future depends to some extent upon the present price as well as upon the future prices. The fact that the effect of present price upon future sales and profits is frequently taken into account is implied in such expressions current among business men as "the danger of spoiling the market," "the difficulty of raising price again when conditions alter, once it has been reduced," "the damage to buyers' goodwill of big fluctuations of prices," "the danger of high price leading to an undermining of the future market by attracting new entrants," etc. It is difficult to telescope all these long-term considerations with regard to the future demand into a single demand curve, the elasticity of which could be regarded as the only relevant determinant of the current profit margin. A purely formal solution of this problem, worked out along the line of Professor Hicks's period analysis, would be that the current price would be determined at such level that the expected marginal revenue from the amount expected to be sold during the current period plus or minus the differences that the production of the marginal unit of output in the present period might be expected to make to the net profits in the future periods, each with its own appropriate price, discounted back to the present period.[2] It is

[1] It is well known that manufacturers, who are in a position to fix their own prices, usually fix their prices and announce them in advance and maintain them over a period or season of production, which is often a year. Such budget period, or the season of production, therefore corresponds more or less to what Professor Lindahl terms the "period of registration"—viz. the period of time during which the entrepreneur may register in his mind the unexpected demand and cost conditions, but would not be able to alter his course of action (in our present case, as far as the price is concerned) until the next period. (Cf. Erik Lindahl, *Money and Capital*, p. 42.)

[2] Cf. J. R. Hicks, *Value and Capital*, Chaps. XV and XVI.

evident that such a situation is not capable of being represented by the intersection of the marginal cost curve and the marginal revenue curve derived from a single demand curve.

Furthermore a recent inquiry by means of direct interviews and questionnaires conducted by Messrs. Hall and Hitch of Oxford[1] has shown that under oligopolistic market condition (which, as we have observed above, is the inevitable concomitant of product differentiation apart from the concentration of production in a small number of firms,[2] and which is therefore a very prevalent phenomenon in an advanced economy) the independent producer commonly holds the view regarding the reaction of his rivals that if he raises his price, he will lose a large amount of his custom to his competitors, who would not follow him in raising their prices, but that if he lowers his price, his competitors would not countenance his attempt to make inroads into their markets and would immediately follow suit in cutting prices. Thus his imagined demand curve tends to be elastic, going upwards from the existing price but inelastic going downwards. This kind of diverse expectations as to the reactions of competitors makes a kink in the imagined demand curve at the current price. As a result, the marginal revenue is indeterminate within a wide range. This situation is depicted geometrically in the accompanying diagram. Such a kink in the demand curve obviously would vitiate the proposition that the profit margin is determined by the elasticity of demand or by the equation of marginal revenue to marginal cost. For at the point of current price the elasticity of demand may have two different values, a greater one for an upward adjustment of price, a smaller one for the downward adjustment, and for a wide range of variation in marginal cost, the existing price might be the one that equates marginal revenue and marginal cost.



The idea of kinked demand curve is endorsed by the Committee on Price Determination of the National Bureau of Economic Research in New York in their recent publication *Cost Behaviour and Price Policy*. In this book, the following opinion is expressed about the Oxford Inquiry: "There is no doubt that this is a realistic picture of the

[1] R. L. Hall and C. J. Hitch, *loc. cit.* The idea of kinked demand curve had been suggested almost simultaneously and apparently independently by Dr. Paul M. Sweezy in an article entitled "Demand under Conditions of Oligopoly," *Journal of Political Economy*, August, 1939.

[2] *Vide supra*, p. 20.

demand situation as envisaged by individual firms in a great number of industrial markets a large part of the time. It goes a long way toward explaining some important aspects of industrial price behaviour. There is rather strong reason for believing that leading firms in the automobile, steel, agricultural implement, and many other industries act upon approximately this view of the situation,"[1] although this statement is later qualified that "as a working hypothesis, however, it is probably limited to industrial markets which have attained something like long-run stability in the sense that the demand is mainly for replacement and the entry of new firms is unimportant. Within these limits the hypothesis is probably not applicable in periods of very high or very low rates of output, nor is it likely to be illuminating if secret price cutting or disguised price changes through alterations in terms of sale are effective competitive devices."[2]

It has thus come to be doubted whether academic economists have not hitherto paid too much attention to what Professor Hicks calls the "marginal condition" in connection with the problem of production and price fixing, while the actual business men appear more likely to be interested in the "total condition"[3]—viz. the condition that in the long run, the total revenue should cover the total outlay plus a reasonable rate of profit on the entrepreneurial capital. Lord Keynes even went so far as to say, "Indeed it is rare for anyone but an economist to suppose that price is predominately governed by marginal cost. Most business men are surprised by the suggestion that it is a close calculation of short-period marginal cost or of marginal revenue which should dominate their price policies."[4]

The majority of the firms investigated by Messrs. Hall and Hitch professed that they normally fix their prices according to what the authors call a "full cost principle." The formula used in computing "full cost" is given as follows: Prime cost per unit is taken as the base, a percentage addition is made to cover overheads, and a further conventional addition (frequently 10 per cent) is made for profit.[5]

This statement, however, is quite ambiguous. First, it is not sure whether the conventional percentage addition for profit is always constant and rigidly maintained when output and sales vary. If it is flexible, it would make quite a lot of difference to price and to the gross profit margin, besides begging the whole question on what principle it is determined. Secondly, the addition for overhead costs

[1] *Op. cit.*, p. 278.
[2] *Ibid.*, p. 278.
[3] For the definitions of these terms see J. R. Hicks, "The Foundations of Welfare Economics," *Economic Journal*, December, 1939, p. 704.
[4] "Relative Movements of Real Wages and Output," *Economic Journal*, March, 1939, p. 46.
[5] Hall and Hitch, *loc. cit.*, p. 19.

might be calculated either by distributing the total overheads over the actual or anticipated output or by distributing it over a "standard" output. And the gross profit margin would behave quite differently according to whether the former or the latter method was adopted for calculating the addition for overhead cost.

If the first method is the predominating one, then, since total overhead cost is more or less inflexible in relation to output and sales, the gross profit margin would tend to vary inversely with the total money value of the products. For the manufacturing industries as a whole, however, this is far from being the case. As can be clearly observed from the accompanying table, from 1919 up to 1929 the gross profit margin appears to have a tendency to increase as the gross value of products increases, although after 1929 this tendency disappeared.

If full cost is calculated predominantly by the second method—i.e. on the basis of a "standard" output, then the percentage gross profit margin would tend to be independent of the output but to vary inversely with prime cost per unit of output. For the total overhead costs and consequently overheads per unit of the standard output are more or less inflexible in the short period and independent of the actual output. Given the percentage addition for net profit, a fall in the current average prime cost will therefore tend to induce a widening of the gross profit margin and a rise in actual prime cost a narrowing of the gross profit margin irrespectively of the actual volume of output. As can be seen from the table on p. 73, from 1921 to 1937, with the only exception of 1933, the rise of gross profit margin does appear to be associated with the steady decline in prime cost per unit, and the fall in profit margin with the rise in unit prime cost. But this association does not hold for 1933, nor for the depression of 1921, in which year there was a sharp drop in unit prime cost, but in spite of this, the percentage gross profit margin declined. And although it is not shown in this table, it also appears that the gross profit margin has increased in the peak boom of 1920 in spite of considerable increase in prime costs. For the prices of manufactured goods increased by 14·7 per cent from 1919 to 1920, while prices of raw materials increased by only 4 per cent and wage cost per unit of product by 12·5 per cent in the same period.[1]

It appears, therefore, that no rigid formula is constantly adhered to in price-fixing. The firms studied by Messrs. Hall and Hitch admit that the "full cost principle," regarded by them as the right and prudent policy, goes by the board in times of deep depression or great boom. But it appears to be well-established that entrepreneurs who fix their own prices generally think of the pricing process in

[1] See Spurgeon Bell, *Productivity, Wages, and National Income*, p. 270.

terms of a percentage addition to their average prime costs, which they take as crude approximations to their marginal costs. It may be that in default of any reliable objective estimation of the individual demand curve and its elasticity along the relevant portion, a rule of thumb price policy, based on the long-period full cost—i.e. current prime cost per unit plus overheads and a reasonable amount of profit

THE PERCENTAGE GROSS PROFIT MARGIN IN THE U.S.A. MANUFACTURING INDUSTRIES

	Gross Value of Products[1] Million dollars	Gross Profit Margin[2] per cent	Prime Cost per Unit of Output[3] (Index)	Value per Unit of Output[4] (Index)
1919	60,054	22·4	100·0	100·0
1921	41,749	21·9	85·0	84·4
1923	58,288	23·2	81·7	82·6
1925	60,926	24·2	79·8	81·7
1927	60,472	25·3	74·3	77·2
1929	68,178	26·7	71·2	75·4
1931	39,830	28·1	56·5	61·0
1933	30,557	27·9	50·4	54·3
1935	44,994	25·0	61·1	63·2
1937	60,713	24·8	66·7	69·0

distributed over a "normal," or "standard," rate of sales that may be expected to be obtained over a number of years, taking good years with bad—may be employed either as a criterion to be achieved or as a convenient starting-point. When times are not too bad and the sales possibility does not depart much from the expected normal, the entrepreneurs might be content to leave well alone and make no attempt to find out, by trial and error, the profit maximizing price. For trial and error are costly and risky, because frequent changes of price are detrimental to buyers' goodwill and a nuisance to wholesalers and retailers alike. But in times of severe decline or big expansion in sales, particularly when these conditions affect all his competitors in the industry, so that there is reason to believe that they will concur in readjusting their price policies, it is not infrequent that the typical producer would be prepared to depart from the conventional rule of

[1] Census of Manufactures figures, as given in the *Statistical Abstract of the United States*, 1939.

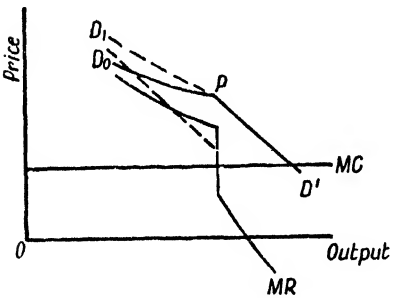
[2] Dr. Kalecki's figures calculated from the Census of Manufactures. For the method of computation see above pp. 91–2 and Kalecki, *Studies in Economic Dynamics*, pp. 22–3, footnote 1.

[3] Total wage bills plus costs of materials, fuel, etc., as adjusted by Dr. Kalecki to include cost of contract work given out, etc., converted into index and divided by the National Bureau of Economic Research index of production of manufacturing industries.

[4] The index of value per unit of output is computed by converting the gross value of products into index and then dividing it with the National Bureau of Economic Research index of production of manufacturing industries.

thumb in view of the current market conditions, with due allowance to such comparatively long-term considerations as the danger of spoiling the market or the probability of attracting new competition into the field and also the various sorts of costs and frictions that might be involved in the announcement of a change in prices.

It is probable that in such changes in price policies, the influence and propaganda of the trade asociations, the amount of consultation and the degree of tacit agreement among the producers are far more important than those factors, which, on purely logical ground, are calculated to affect the market imperfection and the cross elasticities of demands between different individual products—viz. such as the Harrodian effect. The influence upon the price policy and profit margin of the Harrodian effect, or any other factors that might exert some influence on the degree of market imperfection, is perhaps rather limited under the wide spread presumption of kinked demand curves. For with the assumption of a kinked curve—i.e. the assumption that an independent cut of price will be quickly followed by all the competitors, while an independent increase of price will not—the effect of an increase in market imperfection, or a reduction in the cross elasticities of demands between different products, in so far as it is in fact perceived by the producer concerned, is merely to rotate the upper arm of the kinked demand curve upwards with the kink point as the pivot, while leaving the lower arm unaffected. That is to say, it only makes the imagined individual demand curve of the producer concerned less elastic with respect to an upward adjustment of price, but it cannot affect to any appreciable extent the elasticity of the imagined demand curve with respect to a downward adjustment of price, which elasticity depends chiefly on the estimated elasticity of demand for the products of the whole industry. Such a decrease in the elasticity of the upper arm of the imagined demand curve—i.e. an increase in its slope—however, can never entirely straighten out the kink, unless the cross elasticity of the demand for the product concerned with respect to the prices of rival products is reduced almost to zero. Therefore, there will still be a gap of indeterminacy on the marginal revenue curve, though it will be narrowed down to some extent. This situation is represented in the accompanying diagram. If the marginal cost, or average prime cost, has been relatively low as compared with the price, so that the marginal cost curve still cuts



the marginal curve within the range of indeterminacy, which is now somewhat reduced, then the increase in market imperfection, due to, say, the Harrodian effect, would not, by itself, be enough to initiate any change in price policy or profit margin. Only when the range of indeterminacy of the marginal revenue has been so narrowed down that the marginal cost curve now cuts the marginal revenue curve above it, will the entrepreneur be induced to initiate an increase in price and profit margin in spite of the expectation that his competitors may not follow suit.[1] This is more likely to happen with a given percentage change in the elasticity of demand with respect to an upward adjustment of price, the higher is the marginal cost relatively to the original price—i.e. the smaller the original profit margin—and the smaller is the original elasticity of demand with respect to upward adjustment of price. With a fairly big profit margin and an elastic imagined demand for upward price adjustment to start with, a moderate change in market imperfection is not likely to produce by itself any effect on the profit margin.

As regards a reduction in market imperfection, due to, say, the Harrodian effect of a decrease in aggregate real income, it is easy to see that that by itself would not have any effect at all on the price policies and profit margins. For a reduction of market imperfection will only increase the elasticity of demand for the individual product with respect to an upward price adjustment, while again leaving the elasticity of demand with respect to downward price adjustment quite unaffected. It will only make the kink on the individual demand curve less obtuse and thus increase the range of indeterminacy on the marginal revenue curve. If the marginal cost curve has originally run through the range of indeterminacy, it will continue to do so. Therefore a reduction in market imperfection cannot by itself induce any change in price or profit margin.

The movement of profit margins in connection with the fluctuations of industrial activities is, therefore, to be explained chiefly by the changes in the prevailing psychological attitude of the business executives, the policy and influence of the trade associations and such like, and the degree of tacit or explicit collusion among the firms. It may very well be that the movement of profit margins would not lend itself to generalization into some predictable law, or display any definite pattern of behaviour during the business cycles at all.

Our present data[2] reveal that the gross profit margin in the manufacturing industries in the United States from 1919 to 1929 appears on the whole to conform with the traditional belief in having

[1] If the new price has been established for some time and most other firms in the same industry have been induced to adjust their prices in a similar way for the same general reason, then the kink itself will be shifted to the new price.

[2] See the table on p. 73 above.

a tendency to rise with the increase in production and to fall with the recession in activities. Although the profit margin in the depression year 1921 showed only a very slight decline as compared with that in 1919, it probably represented a much bigger fall as compared with that at the peak of the preceding boom in 1920; for there appears to have been an increase in profit margins from 1919 to 1920, as we have pointed out above.[1] This positive association of the average gross profit margin with output, however, cannot be accounted for by the traditional explanation—viz. the tendency for marginal costs to rise relatively to average prime costs with the increase in output. For as we have discussed above the practical manufacturers generally appear to take their average prime costs as more or less constant with changes in output, and our statistics in the previous chapter show that there is no tendency for the productivity of labour to fall with the expansion in output.[2]

The movement of the average gross profit margin after 1929—i.e. during the great depression and the subsequent recovery—however, followed an entirely different pattern from that prior to 1929. In the great depression following the collapse of the boom in 1929, the average gross profit margin, instead of falling as it did in the previous depression in 1921, rose to a level higher even than at the height of the great boom. And the recovery in production from 1933 to 1937 was accompanied, on the other hand, by a decline in profit margins. Thus the pattern of the behaviour of profit margins appears to be exactly the reverse of that prior to 1929.

The steady climb of the average profit margin during the period 1921–29 was attributed by Dr. Kalecki to what he described as a "commercial revolution" which took place during that period. According to him, the great development of modern selling methods, such as advertisement, the constant invention of new products or new distinguishing features, etc., caused an increase in the artificial market imperfection, and the entrepreneurs had taken advantage of this to raise their profit margins. The rise in profit margins in the great depression was explained by him as the consequence of the fact that the severeness of the recession forced the producers into a tacit agreement to raise their profit margins in order to avoid bankruptcy. And the decline in the average profit margin in the subsequent recovery was accounted for by the dissolution of the tacit agreements among the producers, the tendency to prevent the reopening of establishments closed down in the slump and the habit of "careful buying" lingering for some time as an after-effect of the slump—in other words, the hang-over of the Harrodian effect.[3]

[1] *Vide supra*, p. 72.
[2] *Vide supra*, p. 66.
[3] Kalecki, *Studies in Economic Dynamics*, p. 24.

We have already seen above that with the widespread presumption of kinked individual demand curve among the producers, the effect upon profit margins of a change in market imperfection, whether it is due to the artificial product differentiation by advertisement, etc., or due to the Harrodian effect, is rather uncertain. As we have shown, a decrease in market imperfection cannot by itself induce any change in profit margins at all; and whether an increase in market imperfection will induce any widening of profit margins or not is not quite certain. Apart from this, the typical practical entrepreneur in all probability has no precise idea of the magnitude of the elasticity of demand and the effect upon it of a change in the aggregate real income or an intensification of advertising. The explanation of the rising profit margins during the twenties by means of the intensification of advertising, etc., therefore, does not seem to me quite sufficient. Above all, the alleged habit of careful buying lingering after the slump could hardly be an active cause of the decline in profit margins during the recovery after 1934.

Other, and perhaps more important, factors appear to have contributed to the rise of profit margins during the twenties. We must here recall to our mind one outstanding feature of our table on p. 73 comparing the average gross profit margin with the prime cost per unit of output in the manufacturing industries—viz. the fact that since 1921, with the only exception of 1933, the rise of profit margins is always found to be associated with the fall in average prime cost and the decline in profit margins always with the increase in average prime cost. This phenomenon seems to provide us with a useful clue to the explanation of the behaviour of profit margins after 1921. As we have mentioned above, this phenomenon may be explained by the hypothesis that prices of manufactured goods are largely fixed in accordance with the Full Cost Principle of the second type, viz. the method of fixing price at a level which covers the current average prime cost plus overheads cum "reasonable" profit per unit of output distributed on the basis of a standard output.[1] It may legitimately be doubted whether prices are in fact constantly fixed on the rigid basis on such formula and particularly whether the practical entrepreneurs have in fact some inflexible idea of what constitutes the "reasonable" amount of profit or the "reasonable" percentage addition for profit. But this negative correlation between profit margins and average prime costs also suggests a different explanation —viz. in connection with the much-discussed phenomenon of the rigidity or inflexibility of industrial prices. With more or less sticky prices, a fall in prime costs would naturally bring about an increase in gross profit margins, and a rise in prime costs a decline in profit margins.

[1] *Vide supra*, pp. 71–2.

There has been a widespread outcry in recent years in the United States against the rigidity of industrial prices, which has been the subject of many investigations. In the following, we shall analyse the various factors which tend to introduce elements of inflexibility into the price policies of most manufacturing industries and firms, apart from those big monopolistic organizations, which avow a policy of stable prices.

Firstly, in an increasing number of industries, prices are set at the beginning of the period or season of production, which is often a year, and maintained throughout the season, even though the actual costs of production may differ to some extent from what was expected at the beginning of the period.[1] This is largely because of the fact that in such industries prices are fixed in catalogues and advertised as intended to cover some stated period and that the consumers would regard with disfavour changes of prices without due notice. Such convention of price setting may obviously tend to cause price adjustments to lag behind changes in actual prime costs of production.

Secondly, the prevalence of the presumption of diverse reactions of the competing producers to upward and downward price adjustments—i.e. the assumption of a kinked demand curve—might also have the effect of delaying the adjustment of prices to changes in prime costs. For since the marginal revenue to an individual producer is typically indeterminate within a considerable range, a change in his average prime cost of production, so long as it does not shift the average (or marginal) prime cost out of the range of indeterminacy of the marginal revenue, would not directly induce him to adjust his price. It is only when the change in prime costs is believed to affect all the rival producers in a similar way that they will concur in price adjustment—that is to say, price adjustments are made only when the kink points on the individual demand curves have shifted. This affords part of the explanation why industrial prices under oligopolistic competitive conditions are generally rather insensitive to changes in prime costs.

Thirdly, in those industries where there are recognized price-leaders, stable prices have, for one reason or another, usually found favour in the eyes of those price leaders.[2] The classical example is the United States Steel Corporation's price policy with respect to steel rails. This is partly due to the instability of the relations between leaders and their followers. The uncertainty of the loyalty of the followers may fill the price leader with the foreboding that changes in

[1] Cf. A. L. Burns, *The Decline of Competition*, pp. 197–9, and also C. Clive Saxton, *op. cit.*, pp. 33 and 127–8.

[2] Cf. Burns, *op. cit.*, Chap. V, pp. 204–5.

price policy might unduly strain the delicate bond between himself and his followers and consequently lead to a predilection for the avoidance of price changes. When he doubts his capacity to secure the acquiescence of his rivals in what he believes to be the most profitable policy under a changed demand and cost condition, he may deem it wise to "let sleeping dogs lie." Especially during periods of severe decline of demand, when the relation between price leaders and followers is likely to be particularly strained, the price leaders are likely to be very cautious in price reduction lest it should develop into "cut-throat" price competition. This appears to be a special case of the effect of kinked demand curve on the flexibility of prices. Even where the leader feels himself moderately secure with regard to the loyalty of his followers, he may still aim at a more or less stable price for fear that a reduction may create in the minds of buyers a new notion of what is a fair price which may become later an obstacle to attempts to raise the price, or that the buyers or the public may be stimulated into criticism or suspicion of some illegal collusion, if it is an increase of price that is contemplated. Furthermore he may believe that the demand for the products of the industry concerned is inelastic, so that price reductions are considered not worth while. This last constitutes, of course, only one of the reasons why prices are inflexible downwards in those industries where price leadership is well-established; it does not explain why prices should be sticky in case of upward adjustments.

Fourthly, the influences of trade associations have in many ways made for the stickiness of prices. Very often propaganda is conducted to make the individual producers regard it as almost unethical to engage in price competition. In the opinion of the Federal Trade Commission of the United States Senate, "it is probable that trade associations foster an attitude that is favourable to such stability of prices through instilling into members the idea that the lowering of a price will merely tend to demoralize the market."[1] Moreover, the open-price policy pursued by most trade associations increases the speed and accuracy with which the prices quoted by any seller are communicated to others, and thereby reduces the interval within which any price cutter can expect greatly to increase his volume of business because of a difference between his prices and those of his rivals; thus one inducement to price cutting is removed. To quote the Federal Trade Commission,[1] "Perhaps the form of price reporting that most directly conduces to this end is that wherein deviations from announced net prices are reported and distributed to competitors as soon as made. This system does not involve any element of conspiracy or restriction of the liberty of the individual to make his

[1] *Federal Trade Commission, Open Price Trade Associations*, pp. 353–4.

own prices as he will. Yet it may not only be effective in causing substantial uniformity in prices in a market at the same time, at least for a homogeneous commodity, but it may also tend to maintain a constant level of prices from month to month, somewhat regardless of changes in cost, especially, for example, in the cost of raw materials."

Finally, in those industries where a considerable part of the sales is made by contracts to supply goods over a considerable period of time, as in the market for steel rails, newsprint, book paper, and crude oil, the sellers may tend to avoid price reductions, if not price increases, because of the possible pressure from the contracted customers to modify existing contracts if current prices are seriously reduced, and because the reduced price will apply to business for a long period in the future. In some cases, for instance in the steel industries, the sellers have given to their contracted customers guarantees against price reduction—viz. that should the current price of the goods concerned be reduced during the period of the currency of the contract, the lower price would apply to all deliveries made under the contract. A reduction of price necessitates the repayment of a part of the sums received for past sales under contracts still in force, the amount of the refund depending on the duration of contracts. In many other cases, particularly where the producers fix the standard retail prices, guarantees are given to wholesalers and retailers that if price is reduced, the depreciation in the value of the latter's stocks on hand of the commodities concerned, which were purchased at the higher price, will be refunded by the producer. It is obvious that both these kinds of contractual arrangements may often be a deterrent to a reduction of prices. Unless the lowered cost of production can be expected for some long time ahead, the reduction is not usually made. They might perhaps also act as a deterrent to price increase; for unless the increased price can be maintained for some considerable time, the subsequent reduction of price would deprive the producer of much of the gains obtained from the previous price increase.

All these factors tend to introduce some elements of rigidity into the price policies of the manufacturers, and in their combination might have been the chief cause making for the observed negative correlation between the average gross profit margin and the average unit prime cost. It is to be noted that the individual policies under the National Industrial Recovery Act of 1933, with its avowed purpose "to eliminate unfair competitive practices,"[1] its reliance upon trade associations as the chief instruments for the regulation of industries, its "minimum price" and "open price" regulations, and in some cases direct control over prices and outputs, do not appear to have effected an increase in profit margins or the degrees of monopoly,

[1] See § I of the National Industrial Recovery Act.

as defined by Dr. Lerner, in the manufacturing industries. For the average gross profit margin showed a marked decline since 1933 with the increase in prime costs and the gradual recovery in productive activities.

It must be remembered, however, that the negative correlation between profit margins and average prime costs is found only since 1921. For the period 1919–21 this relationship does not hold true. On the contrary, the profit margins appear to have risen in 1920 when the average prime costs also rose, and declined in the depression of 1921 when the latter also fell.[1] This appears to indicate that the rigidity of the prices of manufactured products, though by no means a new phenomenon, perhaps did not assume a far-reaching significance over the whole field of manufacturing industries until the last two decades. The inflationary rise of wholesale prices and the probable increase in profit margins during the boom of 1919–20 suggest that production had probably come up to some bottle-necks in the manufacturing industries. Unfortunately there is nothing in our annual figures given above indicating the presence of bottle-necks; for the average man-hour productivity in 1920 showed a considerable increase and the man-hour employment a slight decline as compared with the corresponding figures in 1919.[2] The annual figures, however, are not very adequate for the study of this particular boom. For the recession began as early as in the spring of 1920, though it started only in a very slight way and did not develop into a collapse until the last quarter of the year. Before the real collapse, wage rates rose rapidly month by month up to June, 1920, when the weekly wage rates stood forty-nine points higher than in June, 1919.[3] There appears, therefore, to have been a shortage of labour, which becomes more apparent if we take note of the fact that the index of factory employment in the first three months of 1920 stood at 115–7 as compared with only 107 in August and September, 1929;[4] a fact all the more striking when it is recalled that the population increased by some fifteen millions in the meantime. According to Professor Douglas, the percentage unemployed of the estimated normal supplies of labour in 1919 was — 0·4 per cent, implying that the number employed in that year exceeded his estimate of the normal labour supply.[5] The shortage of labour was further made worse by the militant attitude of the workers, which resulted in frequent strikes during 1919 and the first half of 1920. In the course of 1919 a large number of strikes occurred, involving over four million workers as compared with over

[1] *Vide supra*, p. 72.
[2] *Vide infra*, pp. 159 and 162.
[3] Paul H. Douglas, *Real and Money Wages in the United States* (1914 = 100).
[4] Bureau of Labour Statistics figures (1923–25 = 100).
[5] Paul H. Douglas, *op. cit.*, p. 547.

one million in the previous year. Therefore it might have been the scarcity of labour—which, as we have pointed out before, is likely to increase the degree of monopsony in labour markets, if not to make the supply of labour completely inelastic—that constituted the bottle-neck of production and made the supply of manufactured goods inelastic; thus causing prices to rise sharply and profit margins to increase.

The recession of profit margins in the ensuing depression year of 1921 in face of severe decline of prime labour and material costs, though no doubt partly due to the disappearance of the bottle-neck of labour shortage, also reflects that price stabilization was then not yet the policy widely aimed at by the manufacturers and that there were few tacit agreements among the producers to keep up prices so that price cuttings had been ruthlessly carried out. Thus there is a great difference between the two depressions of 1921 and 1930–33 in respect of the flexibility of the prices of manufactured goods and the behaviour of profit margins.

NOTE TO CHAPTER V

ON THE MEANING AND MEASUREMENT OF PRICE FLEXIBILITY

THE term price flexibility has been defined in many different ways. Different writers have used this term in different meanings according to the purposes and problems they have on hand. Very often, especially in the hand of statisticians, it is considered to be a phenomenon of price behaviour as such, regardless of the underlying forces that determine the level of the price concerned or set it in motion. Thus price flexibility is often in terms of frequency or amplitude of price changes, the rate of change between high and low points, and in other ways. For instance, Gardiner C. Means, whose study of the relative inflexibility of the industrial prices stimulated the recent crop of discussions on this topic, interprets price flexibility principally in terms of frequency of price changes;[1] and J. K. Galbraith thinks that the amplitude of price change is a more significant measure of flexibility than frequency.[2]

Such purely behaviouristic measurement of the movement of prices is, however, quite devoid of analytical significance. For a relatively stable price does not necessarily mean a rigid price, if the price-determining variables—i.e. the forces that influence the price

[1] Gardiner C. Means, *Industrial Prices and Their Relative Inflexibility*, 74th Congress, 1st Session, Document No. 13, 1935.

[2] J. K. Galbraith, "Monopoly Power and Price Rigidity," *Quarterly Journal of Economics*, 1936, pp. 456–75.

are themselves constant over the period concerned. On the other hand a fluctuating price does necessarily imply a relatively high flexibility, if the relevant price-determining variables are undergoing even more violent fluctuations. And recent investigations of the frequency and amplitude of changes in monthly quotations of wholesale prices in the United States by a number of economists, notably Don D. Humphrey,[1] Rufus S. Tucker[2] and Edward E. Mason,[3] reveal that there is no evidence for the popular belief that the price system in the United States is becoming more inflexible in this price behaviour sense.

Professor Mason suggests that there are two other alternative ways of the term price flexibility, apart from the purely statistical definition.[4] It may be given a normative meaning, in which price flexibility is considered as the relationship between actual and desirable price behaviour. Implicit in such definition is the conception of a norm for price behaviour, with which the actual flexibility of price is to be compared. Prices are considered rigid not because they change infrequently, or fail to respond to changes in some economic variable, but because they do not behave as they should, if economic stability, or some other desirable objective, is to be obtained. Frequently, what the behaviour of prices is supposed to be under perfect competition is taken as the norm. But since there are inherent difficulties in describing exactly what the ideal behaviour of prices consists of, such definition of price flexibility can at most only be a vague theoretical concept.

Professor Mason has rightly pointed out that the most significant interpretation of price flexibility is what he terms the analytical meaning of price flexibility. Under this type of definition, price flexibility is considered in terms of the relationship between price change and the change in price-determining variables. As we have mentioned above, mere statistical measurement of price movement without reference to the underlying price-determining conditions would not give us a very meaningful interpretation of the data of price behaviour. It is quite obvious that, if there is no change in supply and demand conditions, the fact that a certain price does not change is not very significant evidence of inflexibility. Therefore price flexibility must be considered as the rate or degree of response or adjustment of a price to a certain change in the relevant price-determining conditions. However, we must not include all the

[1] Don D. Humphrey, "The Nature and Meaning of Rigid Prices, 1890–1933," *Journal of Political Economy*, 1937.

[2] R. S. Tucker, "The Reasons for Price Rigidity," *American Economic Review*, 1938, pp. 41–54.

[3] Edward E. Mason, "Price Flexibility," *Review of Economic Statistics*, May, 1938, Part II, pp. 58–64.

[4] Mason, *loc. cit.*, Part I, pp. 53–58.

relevant price-determining variables into the conditions, to whose change a price is supposed to adjust itself at a certain rate or degree. For if we include all the relevant variables, the position of a price at any point in time is always completely determined, and there is no point in speaking of flexibility as a rate or degree of adjustment, since the price is always perfectly adjusted. Problems of relative price flexibility arise, because with a change in certain of the price-determining variables, one price reacts in a different way from another.

Thus, for instance, Professor Alvin H. Hansen defines the Cyclical Price Flexibility as the response of commodity prices to changes in the national incomes, and the Structural Price Flexibility as the adjustment of prices to changes in unit costs.[1] And H. L. Moore defines his coefficient of simple flexibility as the relation between relative change in quantity of a given commodity and the relative change in its price.[2] If the demand curve can be assumed to remain constant, this coefficient is simply the reciprocal of the Marshallian elasticity of demand. Later he advanced the concept of the coefficient of partial flexibility, which indicates the relation between a relative change in one or more variables, of which price is a function, and the relative change in price.[3] This is, of course, simply a mathematical formulation of the functional relationship assumed to exist between various economic variables and the price.

As we have seen in the preceding chapter, however, the manufacturers generally quote their own prices, either individually or on the basis of some tacit or conventional agreement among the producers of the same industry, by adding a certain percentage to the average prime costs, which they take as approximately constant with respect to small variations of their own output, to cover their overhead costs and profits.[4] Since prices of manufactured goods are mostly fixed on the basis of a percentage addition to the average prime cost, and since average prime costs are largely independent of the price policy of the manufacturers concerned, being largely determined by the extraneous factors—e.g. the technical conditions and the prices of materials and labour—whereas the percentage additions, or the profit margins are largely a matter of their own policies, we may usefully think of price flexibility in terms of the degree of adjustment of a price to a certain change in the average prime cost. The rate or degree of adjustment may, of course, be considered from two angles, viz. from the point of view of the amplitude of price adjustment

[1] A. H. Hansen, *Fiscal Policy and Business Cycle*, pp. 313–4.
[2] H. L. Moore, "Elasticity of Demand and Flexibility of Prices," *Journal of American Statistical Association*, 1922, pp. 8–19.
[3] H. L. Moore, "Partial Elasticity of Demand," *Quarterly Journal of Economics*, 1926, pp. 393–401.
[4] *Vide supra*, pp. 71–4.

relative to the change in average prime cost as well as from the point of the speed or time-lag in adjustment. Since the data in our study are annual figures, the investigation of time-lags in adjustment must perforce be left out. Only the rate of adjustment in the sense of the relation between the relative change in price and the relative change in the average prime cost can be considered. If there can be observed a persistent tendency for the price series of a certain manufactured commodity, or group of such commodities, to move less than proportionately to changes in the corresponding average prime cost over a number of years, including years of rising unit prime cost as well as years of falling cost, we may then regard it as the evidence of rigidity in price policy. If the price tends predominantly to fluctuate proportionately, or more than proportionately, to changes in average prime cost, we may regard the price as flexible. Between these two obvious cases, there are of course intermediate cases, where there is no predominant tendency for price either to fluctuate less than proportionately to average prime cost, or to fluctuate proportionately or more than proportionately to cost.

With the term price flexibility thus interpreted, we find that there is some evidence for the widely held view that the price system in the United States manufacturing industries is becoming more inflexible. The table on p. 73 reveals that since 1923 there is a persistent tendency for the average profit margin in manufacturing industries as a whole to be negatively associated with the average unit prime cost, i.e. that there is a persistent tendency for the average value per unit of output to change less than proportionately to the changes in the average prime cost. Such tendency did not exist in the earlier years; in the boom of 1920, the sharp rise of prices was far in excess of the rise in prime costs, and in the subsequent depression of 1921, prices dropped even more spectacularly and profit margin declined in spite of a severe fall in prime costs.[1] This forms a strong constrast to the behaviour of prices during the depression of 1930–33 and the recovery of 1933–37.

[1] *Vide supra*, pp. 72 and 82.

CHAPTER VI

PRODUCT WAGES AND PROFIT MARGINS IN THREE SELECTED MANUFACTURING INDUSTRIES

THE conclusions of the two preceding chapters are somewhat disturbing to our traditional belief. We have seen there that there is no definite cyclical pattern in the movements of the average gross profit margin in the manufacturing industries as a whole. It indeed declined during the depression of 1921 and rose gradually as the recovery developed into the great boom of 1929. But after the collapse of the boom in 1929 it continued to rise and stayed at a very high level, from which it fell only as the recovery progressed. We have also seen that as regards the rate of product wages in manufacturing industries, there is only a faintly recognizable negative correlation between the level of employment and the product wage rate up to 1931, after which year hardly any correlation appears to exist. And the factors which used to be adduced to explain the movement of the product wage rates, viz. the diminishing productivity of labour and the variation of profit margins whether due to the Harrodian Law of Diminishing Elasticity of Demand or to the mere time-lag of the adjustment of cost to price, do not appear to be adequate to account for the movements and the vague correlation between employment and product wages. What correlation there appears to have existed, seems to be chiefly the result of the variations of the ratio of wage rates to raw material prices, which shows a distinct negative correlation to the level of employment.

These conclusions are disturbing enough to demand further close investigation. It may be pointed out that average gross profit margin might be influenced in one way or other by the shift in the weights to be given to different industries as the relative volumes of their outputs change during the business cycle. As we mentioned above, our figures for the gross profit margin in the manufacturing industries as a whole are virtually the averages of the profit margins in the different manufacturing industries weighted in proportion to the gross values of their products. There is no doubt that gross profit margins vary greatly from industry to industry. This is clearly shown by the table on p. 87, which is adapted from Dr. Charles A. Bliss's study, *The Structure of Manufacturing Industries*, and which gives the profit margins in twenty of the more important manufacturing industries.

The profit margins vary in these twenty industries from 62 per cent in the newspaper and periodical branch of the printing and

publishing industry and 59 per cent in the cigars and cigarettes industry to 6 per cent in the steam railroad repair shops and 8 per cent in the meat packing industry. Obviously, if industries with comparatively large profit margins expand in relation to industries with comparatively small profit margins, the average profit margin for manufacturing industries as a whole would increase, even if the

GROSS PROFIT MARGINS OR OVERHEAD COSTS PLUS PROFITS AS PERCENTAGES OF VALUES OF PRODUCTS IN TWENTY SELECTED MANUFACTURING INDUSTRIES IN 1929

	Industries Ranked by Value Added[1]	Gross Profit Margin per cent
1.	Foundry and Machine Shop Product (1, 4)	38
2.	Iron and Steel: Steel Works and Rolling Mills (4, 3)	22
3.	Printing and Publishing, Newspaper and Periodicals (17, 7)	62
4.	Electrical Machinery, Apparatus and Supplies (6, 6)	38
5.	Motor Vehicles, not including Motor Cycles (7, 1)	25
6.	Lumber and Timber Products (not elsewhere classified) (3, 12)	34
7.	Bread and other Bakery Products (11, 10)	34
8.	Clothing, Women's (not elsewhere classified) (13, 8)	31
9.	Printing and Publishing, book and job (14, 16)	49
10.	Cigars and Cigarettes (19, 14)	59
11.	Motor Vehicle Bodies and Motor Vehicle Parts (8, 9)	20
12.	Steam Railroad Repair Shops (5, 13)	6
13.	Cotton Goods (2, 11)	20
14.	Petroleum Refining (26, 5)	18
15.	Furniture, including Store and Office Fixtures (12, 20)	29
16.	Clothing, except work, men's, youths' and boys' (15, 22)	31
17.	Meat packing, wholesale (18, 2)	8
18.	Boot and Shoes, other than rubber (10, 19)	24
19.	Knit goods (9, 23)	26
20.	Paper (20, 18)	26
	Median	28

profit margins in each individual industry have not altered at all; and conversely.

To assess precisely the influence which the cyclical shifting of the relative importance of different industries has upon the behaviour of the average profit margin in manufacturing industries as a whole, we shall have to examine the variations in profit margins and the values of products in all the manufacturing industries. Time and space, however, preclude us from embarking on such an ambitious scheme. We shall be content to estimate in a rough and ready way the possible influence upon the behaviour of the average profit margin of the variation of the relative magnitudes of the outputs of investment

[1] The rank indicated is that in the total of 326 industries. The numbers in brackets following the industry title refer to rank by number of wage earners and value of product respectively.

goods and consumption goods, now that it is a well-established fact that in the upswings the former tends to expand relatively to a greater extent than the latter and that conversely the former tends to shrink relatively to the latter during the downswings. The effect of the variation of the relative volumes of output of the different industries within each of the twin divisions of the investment goods and the consumption goods industries, however, may be expected more or less to cancel out, as the distribution of the sizes of profit margins among those different industries is quite haphazard and random.

In the following table, also adapted from Dr. Bliss's study,[1] it can be seen that the averages of profit margins in the capital goods

GROSS PROFIT MARGINS IN MANUFACTURING INDUSTRIES CLASSIFIED ACCORDING TO ULTIMATE USE OF PRODUCT,[2] 1929

Ultimate Use	Capital Goods	Consumers' Goods	Construction Materials	Producers' Supplies	All Manufacturing
Profit Margin (percentages)	29·8	28·9	29·7	29·0	29·2

and construction materials industries are only very slightly bigger than that in consumers' goods industries. The profit margins in capital goods and construction materials industries are 0·6 per cent and 0·5 per cent respectively bigger than the average for all manufacturing industries, while that in consumers' goods industries is 0·3 per cent smaller. Thus it seems that a mere variation of the relative volumes of output of consumers' goods and capital goods would not bring about any significant change in the average profit margin of manufacturing industries as a whole. If it is to have any effect at all

[1] *Op. cit.*, p. 59, Table 12.

[2] Bliss's classification of consumers' goods and capital goods is identical with Dr. Simon Kuznets' classification of consumers' goods and producers' goods. Dr. Kuznets defines his terms as follows: "Consumers' goods—commodities and services that, whether finished or unfinished, are, when finished and at their destination, used by households or large ultimate consuming units. Examples: flour, bread, raw wool, clothing. Producers' goods—commodities and services, whether finished or unfinished, that are, when finished and at their destination, used by business agencies in the process of production. Examples: industrial machinery; steel used therein." (*National Income and Capital Formation*, 1913–35, p. 37 footnote.) See Bliss, *op. cit.*, pp. 13–14 and footnote p. 14. Manufactured construction materials, although serving ends not unlike the products in the capital goods group, are put into a separate group because of the direct importance of residential construction from the consumers' point of view. Miscellaneous producers' supplies—i.e. non-durable commodities used by producers both inside and outside the manufacturing system for which no adequate accounting by ultimate product could readily be made, viz. (1) producers' fuels, etc., (2) containers, (3) other producers' supplies, such as stationery, etc.—are also put into a separate group.

upon the average profit margin, the effect would be to increase the profit margin slightly during the upswing and to lower it slightly during the downswing. It certainly cannot help to account for the continued rise of the average profit margin from 1929 to 1931 and its decline during the recovery of 1933–37.

It is, nevertheless, of interest to see how the profit margin and the rate of product wages behave in some particular industries and to compare how far the behaviour of profit margin and product wages in those particular industries conforms with the general pattern for manufacturing industries as a whole. In the following, we shall examine three particular industries in the United States, chosen chiefly for the availability of data concerning them—viz. the Cotton Manufacturing, Paper and Pulp, and Iron and Steel industries. These industries happen to fall roughly into the twin divisions of industries, viz. the consumers' goods, and the capital goods industries. The cotton and paper industries may be regarded as mainly consumers' goods industries, inasmuch as their products, when finished, are chiefly destined to be used by the consumers. The iron and steel industry may be regarded as in the main an investment goods industry, inasmuch as its products, when finished, are chiefly destined to be made into capital equipment used by business agencies in the process of production, or to be turned into durable consumers' goods which are not unlike capital equipment in the nature of the demand for them. Thus they would provide a sample, though not necessarily a representative or typical one, for each of the two divisions of industries.

Cotton Textile Industry

The cotton textile industry has been frequently pointed out as an instance of a large industry in which the degree of concentration and combination is comparatively unimportant. Owing to the fact that in nearly all the branches of the industry maximum productive efficiency can be achieved by mills of moderate size, producers in this industry are numerous and small, and entrance into the industry is fairly unobstructed. According to Professor Clair Wilcox, the productive units are generally rather small, as can be seen from the fact that among all the cotton textile establishments in the United States in 1929, four-fifths had fewer than five hundred employees each and three-fourths had fewer than two hundred and fifty. The degree of combination of management is also comparatively low from the point of view of the entire industry. The largest four among 900 to 1,000 firms operated twenty-five establishments, which produced only 8·4 per cent of the total output, by value, in 1935, and the largest eight operated fifty-eight establishments which produced only 14·4 per cent. The fifteen largest companies selling cotton yarn accounted

for only 18·3 per cent of the production, the largest of them for only 4·8 per cent in 1934–35. The fifteen largest selling woven goods accounted for only 40 per cent, the largest of them for only 4·6 per cent.[1]

Such comparision between the output of individual concerns and that of the entire industry, or branch of industry, however, is apt to be misleading in that it gives a false and exaggerated sense of the competitive nature of the cotton industry. For since different firms might specialize on different fabrics, the degree of concentration is certainly much higher where individual products are concerned. Dr. W. F. Crowder, in his monograph on *The Structure of Industry*, prepared for the Temporary National Economic Committee, has shown that in 1937 out of the eighty-nine products classified as "cotton woven goods over 12 in. in width," seventy-four products (or 83·1 per cent of the items) have a concentration ratio of above 50 per cent; thirty-four (or 38·2 per cent of the items) have a concentration ratio of above 75 per cent,[2] the concentration ratio being defined as the percentage of the United States total value of each product accounted for by the output of the four leading producers.[3] Thus with regard to the individual products of the cotton industry, the market is highly oligopolistic in spite of the large number of firms in the entire cotton industry.

There are also organized trade associations in all branches of the industry, some local, some national in their sphere of activities; for instance, the Cotton Textile Institute, the National Association of Hosiery Manufacturers, The Southern Yarn Spinners' Association, the Arkwright Club, the North Carolina Cotton Manufacturers' Association, the South Carolina Cotton Manufacturers' Association, etc. These associations have served as the organ for discussion and consultation among the producers and might have been instrumental to agreement on common policies. There have been cases where trade associations openly attempted to restrict output and sales. For example, during 1925 and 1926 the Southern Yarn Spinners' Association issued frequent bulletins in which it urged its members to confine production to the volume required to fill orders and to restrict their output as orders declined. The resulting curtailment took the form of a complete suspension of operations during one or more days in each week.[4] Again in 1930 the Cotton Textile Institute adopted the so-called 55–50 plan, under which three-fourths of the firms in the industry agreed to limit day shifts to fifty-five and night shifts to fifty

[1] Wilcox, *Competition and Monopoly in American Industry*, T.N.E.C. Monograph No. 21, pp. 31–2.

[2] Thorp and Crowder, *The Structure of Industry*, T.N.E.C. Monograph No. 27, Appendix B, pp. 420–81, especially pp. 426–9.

[3] *Ibid.*, p. 274.

[4] Wilcox, *op. cit.*, p. 250.

hours per week. In 1932 the Institute promoted curtailment programmes in several branches of the industry, notably in print cloth mills, which undertook to reduce their output by amounts which ranged from 10 per cent to 50 per cent.[1] The prices of cotton goods, however, are not stabilized for any length of time, but are highly flexible in terms of both frequency and amplitude of changes—i.e. in the statistical price behaviour sense.[2]

In the following chart (Chart IX), we compare together the indices of output, product wage rates (inverted, and with trend eliminated), the wholesale prices of cotton goods and the hourly money wage rates in the American cotton textile industry. The index of product wage rates is obtained by dividing the index of average hourly money earnings of labour in cotton industry by the index of the Bureau of Labour Statistics index of wholesale prices of cotton goods. The index so derived shows considerable secular trend, rising from 100 in 1919 to 252·6 in 1938. The trend is here removed by taking the deviations from a second degree parabola fitted by means of the least square method.[3]

It can be seen that for parts of the period 1919–38, the turning-points in product wage rate inverted appear to correspond to a considerable extent with those in the index of output, particularly after 1929. Such correspondence, however, was absent for the years 1922–29, during which the fluctuations in output appear to have no effect on product wages which rose fairly smoothly during this period. Thus the relationship between product wages and output in the cotton industry seems to be rather different from that in manufacturing industries as a whole. In the latter, as we have seen above, the vague correlation observable between product wages and employment during the first half of the period 1919–38 tends to disappear altogether after 1929; whereas in the present case, the correlation becomes more prominent only after 1929.

Prices and wages moved in fairly close correspondence to each other. There are, however, two instances in which the turning-points

[1] *Ibid.*, p. 250–1.

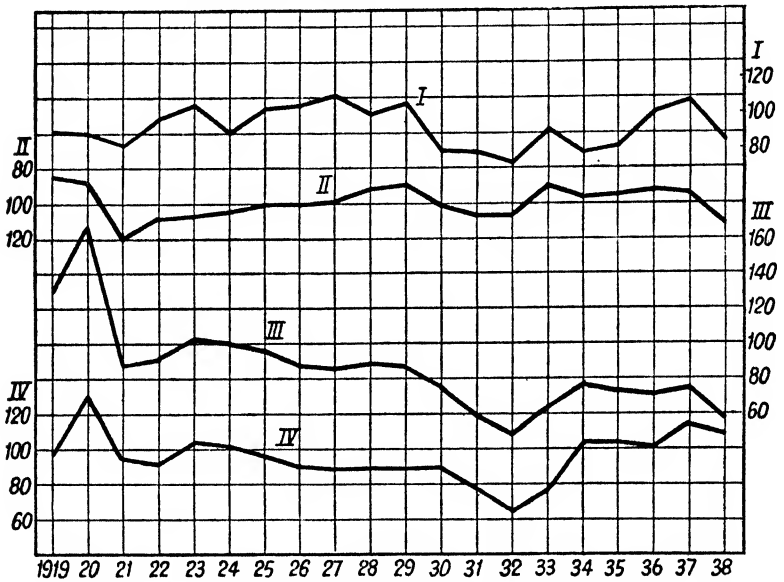
[2] *Ibid.*, p. 32. "Among twenty-five of the industry's products, four showed more than ninety month-to-month price changes in ninety-five months from 1926 to 1933; twelve showed more than sixty changes; eighteen showed more than thirty; none showed less than twelve. The prices of twenty-four products dropped more than 30 per cent from June 1929 to February 1933; those of twenty-one dropped more than 40 per cent; those of fourteen dropped more than 50 per cent. The price of heavy drill fell 63 per cent, that of light drill 64 per cent. During these years the production of cotton goods declined by only 26 per cent. From their depression lows to their peaks in 1937, the prices of four products rose by more than 150 per cent, those of eleven by more than 100 per cent and those of twenty by more than 75 per cent. In the same period, production rose by 33 per cent."

[3] The equation for the trend of product wages is calculated to be: $y = 147{\cdot}62 + 2{\cdot}786x + 0{\cdot}067x^2$, with the origin at the beginning of 1929 and x in units of six months.

in money wage rates lag in time behind the turning in prices and production—viz. 1922, in which year money wages continued to decline slightly while prices and production of cotton goods already turned to rise, and 1930, in which year money wages rose very slightly, whereas prices and production already began the plunge into the depths of depression. There is no evidence for the common belief that

CHART IX

HOURLY MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES OF COTTON GOODS, AND PHYSICAL OUTPUT IN COTTON TEXTILE INDUSTRY IN THE U.S.A. (1919–38)



Curve I: Index of physical output.
Curve II: Index of product wage rates, with trend eliminated and inverted.
Curve III: Index of wholesale prices of cotton goods.
Curve IV: Index of hourly money wages.
For data see Statistical Appendix to Chap. VI, Table IX, p. 164.

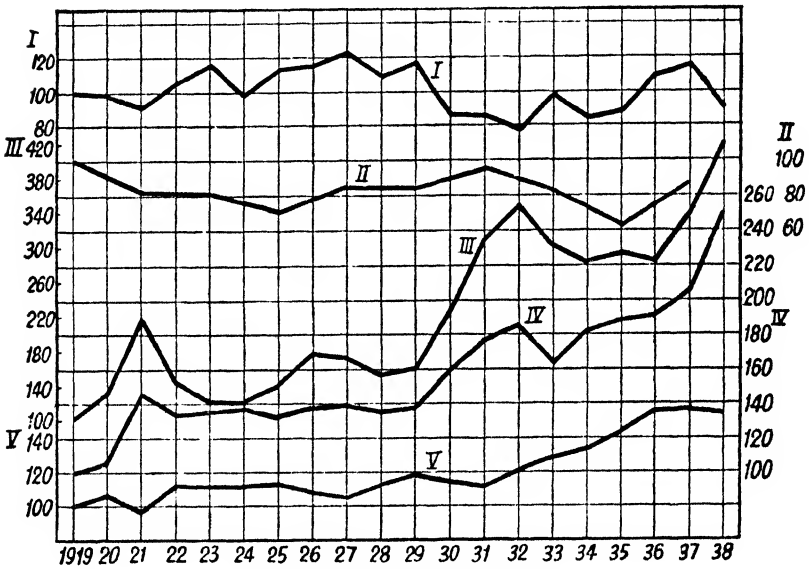
money wage rates tend generally to fluctuate less in amplitude than prices of products. For during the seven years in which money wages had risen, product wages with trend unremoved increased for five years and decreased for only two years, and after we have removed the trend from product wages, the latter still increased for four years out of the seven years in which money wage rates increased. During the twenty-years period, money wage rates fell for eleven years, in which the product wage rates with the rising trend unremoved rose

in nine years and fell in two years, but in which product wage rates with trend removed rose in only five years and fell in six years.

In the next chart (Chart X), we compare together the indices of product wage rates (with trend), man-hour productivity of labour, the ratio between money wage rates and raw cotton prices, and the gross

CHART X

PRODUCT WAGE RATES, MAN-HOUR PRODUCTIVITY, RATIO OF MONEY WAGE RATES TO RAW COTTON PRICES, AND GROSS PROFIT MARGIN IN COTTON TEXTILE INDUSTRY IN U.S.A. (1919–38)



Curve I: Index of physical output.
Curve II: Index of gross profit margin.
Curve III: Index of the ratio of money wage rates to raw cotton prices.
Curve IV: Product wage rates with trend unremoved.
Curve V: Man-hour productivity.

For data see Statistical Appendix to Chap. VI, Tables IX and X, pp. 164–5

profit margin in the cotton textile industry. It is obvious at a glance that the productivity of labour does not help at all to explain the year to year fluctuations of product wage rates, although the general trend of the former is vaguely parallel to that of the latter, being both more or less horizontal at first and then turning rather abruptly into an upward slope. The fluctuation of productivity, however, appears to be quite uncorrelated with that in the rate of product wages. In some years productivity actually moved in the opposite direction to

product wage rates. For example, in 1921, the productivity of labour declined, while product wages rose sharply, and in the next year, while product wages receded, man-hour productivity on the contrary increased. The movements of the productivity of labour during the periods 1925–28, 1929–31, 1932–33, and 1937–38 were also opposite to that of product wages. Moreover, the changes in productivity do not appear to bear any definite correlation with the output of cotton goods either.

The ratio of money wage rates to raw cotton prices, however, appears to have an obvious influence on the variations of product wages. In many years the movement of this ratio seems to overwhelm altogether the opposite influence of the productivity of labour. But there are also a few cases in which the movements of the ratio of money wages to raw cotton prices appear to be unable to account for the changes in product wages—e.g. 1922–23, 1924–25, and 1933–34. In these cases, changes in gross profit margin perhaps had the strongest influence upon the product wage rates.

The effect of the changes in gross profit margin upon product wages in the cotton industry, however, cannot be fully observed, since only biennial figures can be reliably obtained from the Census of Manufactures. The index of profit margin employed here is calculated for each census year by dividing the difference between the gross value of products and wage bill plus costs of materials, fuel, etc., by the gross value of products in the cotton goods industry, and then converting the percentage figures of profit margin into a series of indices with 1919 as base. Before 1935, however, the Census does not include among the costs of materials, etc., cost for contract work given out, which obviously must be counted as prime cost. But unless the cost for contract work as a proportion of the total prime cost changes widely from year to year, the index of profit margin thus calculated from the Census data would provide an adequate indication of the relative movements of profit margin for these years, particularly if the cost of contract work is only a very small proportion of the total prime cost. The Census figures of costs of materials, etc., for 1935 and 1937, however, are calculated to include cost of contract work. Fortunately, for 1935 costs of materials, fuel, etc., not including cost of contract work, are also given for comparison with previous years. Thus we can first calculate the index of profit margin up to 1935 inclusive, omitting cost of contract work from prime cost, and then calculate the index number for 1937 with 1935 as base, using the new figures of costs of materials, etc., that include cost of contract work, and finally join it to the previous series. As can be seen from the revised and unrevised figures of costs of materials for 1935, the cost of contract work given out amounted to only one-sixtieth of the

total cost of materials, etc. Thus this method would give us quite an adequate index of the gross profit margin in cotton goods industry. The figures of material costs for 1933 and 1935 also include processing taxes imposed under the Agricultural Adjustment Act and discontinued in 1936 after the Supreme Court ruled that the control of agricultural production was "a matter beyond the power delegated to the Federal Government." As the processing tax was to be paid in proportion to the amount of cotton consumed, it is as much a part of prime cost as the price of raw cotton. No attempt is therefore made to eliminate this item.

The variations of profit margin appear to be positively associated with the changes in physical output, except during the periods 1921–23 and 1929–33. There was a decline in profit margin in the depression of 1921, which partly accounts for the big jump in product wages in that year. But the brisk recovery of production from 1921 to 1923 was accompanied by, if anything, a very slight fall in profit margin. From 1923 to 1929, profit margin and output appear to be more in correspondence to each other, but from 1929 to 1933 they moved in opposite directions. From 1933 to 1937, they are positively associated again.

This relationship between profit margin and output cannot be explained by the law of diminishing returns, for as we have observed there is no definite correlation between output and productivity of labour. A new light, however, can be thrown upon the variations of profit margin when we compare the unit prime cost with the sales value per unit of output. The index of unit of prime cost of the cotton goods industry can be obtained by dividing the index of total prime costs—viz. wage bill plus costs of materials, fuel, etc., as given by the Census of Manufactures and converted into index, with the index of the physical output of cotton goods.[1] The index of value per unit of output can be similarly obtained by dividing the index of gross value of products, based on the census data, by the index of output. The index of unit prime cost is set against the index of gross value per unit of output and the index of gross profit margin in the table at the top of p. 96.

It can be seen that since 1925, the movement of value per unit of output invariably lags, in its amplitude, behind that of unit prime cost, so that a fall in prime cost is always associated with a rise in profit margin and a rise in prime cost is always associated with a fall in

[1] The difficulty that the census figures of material costs prior to 1935 do not include costs of contract work, whereas after 1935 they do, is overcome by calculating the index of total prime cost (wage bill plus costs of materials, fuel, etc.) in two sections and then connecting them together. The processing tax in the census figures of material costs for 1933 and 1935 are not eliminated, because it is as much a part of the prime cost as the price of raw cotton. (Cf. above, p. 94.)

profit margin, with the sole exception of the period 1931–33. The positive association between profit margin and output during the periods 1925–29 and 1933–37 can now be explained by the fact that during these periods the years of increasing output happened to be the years of falling unit prime cost and the years of declining output

GROSS VALUE AND PRIME COST PER UNIT OF OUTPUT, AND GROSS PROFIT MARGIN IN THE COTTON INDUSTRY IN THE UNITED STATES

Year	Value per Unit	Unit Prime Cost	Profit Margin
1919	100·0	100·0	100·0
1921	65·4	68·9	82·0
1923	76·5	80·8	81·2
1925	70·6	76·7	71·4
1927	59·9	62·3	86·8
1929	61·1	63·7	85·5
1931	44·0	44·4	97·1
1933	40·6	42·5	84·3
1935	51·5	57·1	63·7
1937	48·8	50·7	89·1

happened to be years of rising unit prime cost. The stickiness of prices which prevented them from moving in the same proportion as unit prime costs, thus brought about the positive association between the gross profit margin and output observed during these periods. The opposite movements of profit margin and output can be similarly accounted for by the sharp fall in unit prime cost with the decline of output during those years.

Before 1925, however, there appears to be no such tendency of price offsetting insufficiently the changes in unit prime cost. In the depression of 1921, there was a severe decline in unit prime cost (from 100 in 1919 to 68·9 in 1921), but value per unit of cotton goods dropped even more drastically and gross profit margin manifested a decline of 18 per cent. Although during the period 1921–23 value per unit just failed to rise as much as unit prime cost, in the period 1923–25 the former declined to a greater extent than prime cost and profit margin also fell. This seems to indicate that the stickiness of price, which appears to be an established phenomenon from the late twenties onwards, was not yet a prevalent condition in the cotton industry in the early twenties. It thus seems to lend further support to the widely held opinion that the price system of the American manufacturing economy is becoming more inflexible, which opinion is not always supported by a mere comparison of the frequency and amplitude of price changes.

Thus in spite of the fact that prices of cotton goods have been

on the whole highly flexible in the price behaviour sense—i.e. in terms of frequency and amplitude of variations—they may nevertheless be considered as somewhat sticky from the latter half of the twenties onwards according to our definition, inasmuch as the average value of the products generally tend to offset insufficiently the changes in unit prime cost.

Paper and Pulp Industry

The paper industry is generally recognized as an oligopolistic industry in which production is highly concentrated. It is shown by Dr. Crowder that in 1937 out of the sixty-three products classified as "paper and paper board," thirty-eight (or 61·7 per cent of the items) have a concentration ratio of above 50 per cent, the concentration ratio being defined as the percentage of the United States total value of each product accounted for by the output of the four leading producers. In the case of ground wood printing paper, four producers out of a total number of eleven produced in 1937 more than three-fourths of the total value. In the case of newsprint, four producers out of a total of twenty-three produced in 1937 68·1 per cent of the total value produced in the United States.[1] Indeed, in the market of newsprint, the Canadian supply must be considered side by side with the American output, not only because of the importance of Canada as a source of the product, but also because newsprint enjoys, since 1913, the almost unique distinction on this continent of being an important manufactured commodity which is not subject to tariff restriction. Nevertheless, the newsprint branch of the paper industry remains one of the highly oligopolistic industries; for in Canada, as in the United States, not only is the manufacturing unit very large, but merger has been carried out to a very great extent. In 1930, the four largest companies—viz. the International, Canada Power and Paper (later becoming the Consolidated Paper Corporation, Ltd.), Abitibi Power and Paper and Price Brothers—controlled about 63 per cent of the total Canadian capacity.[2]

There are organized trade associations both in the United States and Canada; in the former, the American Paper and Pulp Association, and in the latter, the Canadian Pulp and Paper Association. These bodies not only keep their members informed regarding all matters of general interest to the industry, but also take the initiative in forming policies and advising courses of action supposed to be advantageous to all members.[3]

[1] Thorp and Crowder, *op. cit.*, Appendix B, pp. 438–9.
[2] Cf. John A. Guthrie, *Newsprint Paper Industry*, p. 65, and also *Financial Post*, 26 September, 1931.
[3] *Ibid.*, p. 94.

The prices of paper were inflexible in the price behaviour sense. As shown by A. R. Burns, the price of writing paper changed only once between 1923 and 1931, and the prices of book paper and newsprint changed but infrequently.[1] As regards newsprint, there is a long-established tendency of producers to follow the price policy of one large company. From 1923 to 1928, the International Paper Company maintained almost unchallenged the position of price leader in the entire North American market east of the Rocky Mountains. The International generally took the lead in announcing the price for the coming year. Other producers subsequently adopted it as their own. Contracts signed by members of the trade called either for the delivery of newsprint at the average price charged by the three largest firms or at that announced by the International.[2] After 1929, there was a struggle for price leadership between the International, Price Brothers and Great Northern, which threatened to develop into competitive price cutting among the large producers. This was, however, timely averted by the inauguration of the codes set up under the National Industrial Recovery Act, which stimulated, and presumably provided a means of enforcing, concerted action among the producers. In 1936 Great Northern assumed the price leadership, which was not regained by the International until 1938.[3] On the Pacific Coast, west of the Rockies, the Crown Zellerbach Company, the largest producer of that region, used to announce the price, but in 1933 the Powell River Company took over the leadership.[4]

In the accompanying chart, we compare together the indices of man-hour employment, the wholesale prices of paper and pulp, the average hourly money wages and the average product wage rates (as expressed by the ratio between the two preceding items and with

[1] A. R. Burns, *The Decline of Competition*, p. 203.

[2] Clair Wilcox, *op. cit.*, p. 130. When the Federal Trade Commission investigated the industry in 1929, it came to the conclusion that: "The International Paper Co. really makes the market price of newsprint paper for the entire United States except for the Pacific Coast." The sales manager of the Great Northern Paper Co. told one of the Commission's attorneys that: "other manufacturers could not ask a higher price and would not accept a lower price than International made. If they asked a higher price, they ran the risk of losing their customers. If they accept a lower price they invite further reduction by the International." (F.T.C., *Newsprint Paper Industry, 71st Congress, special session, S.Doc.*, No. 214, p. 81.) This indicates clearly that price-followers generally operate under the assumption of a kinked demand curve, with the kink at the price set by the price-leader.

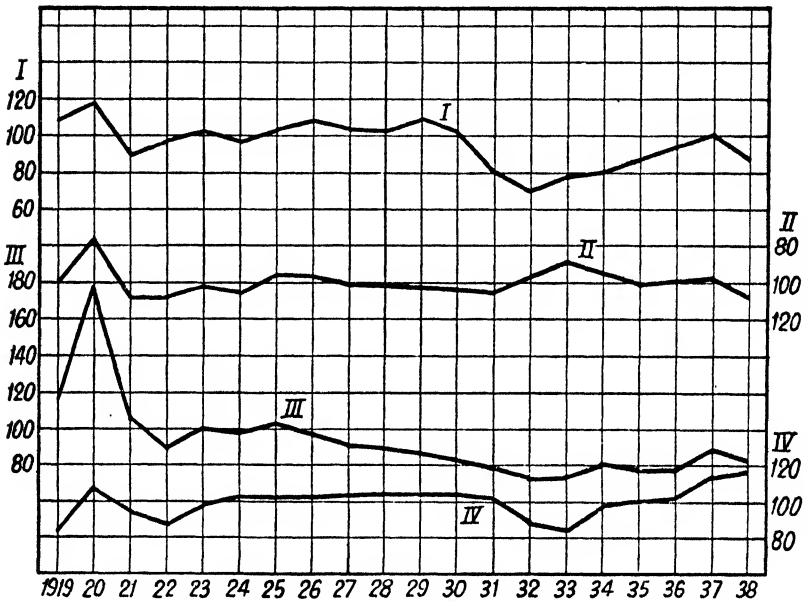
[3] Guthrie, *op. cit.*, pp. 108–12.

[4] *Ibid.*, p. 113. In 1939 an indictment was returned against the Crown Zellerbach Corporation and three other companies, which together with the former produced over three-quarters of the newsprint sold in six Pacific Coast and Mountain States, charging them with conspiring to suppress competition, allocate markets, and fix and maintain terms of sales. If the facts alleged in this action are true, the price of newsprint in this area is a product of tacit agreement rather than leadership. (Wilcox, *op. cit.*, p. 131.)

trend eliminated)[1] in the paper and pulp industry[2] in the United States. It can be observed that there is some negative association between the movement of product wages and that of employment up to 1928, after which year no correlation appears to exist, except that from 1937 to 1938 product wages did rise while employment fell.

CHART XI

HOURLY MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES OF PAPER AND PULP, AND MAN-HOUR EMPLOYMENT IN PAPER AND PULP INDUSTRY IN THE U.S.A. (1919–38)



Curve I: Index of man-hour employment.
Curve II: Index of product wage rates with trend eliminated and inverted.
Curve III: Index of wholesale prices of paper and pulp.
Curve IV: Index of hourly money wages.
For data see Statistical Appendix to Chap. VI, Table XI, p. 166.

Again for the first half of the period (in the present case, from 1919 up to 1931), a change in the price of the products generally brought a change in product wages in the opposite direction, indicating

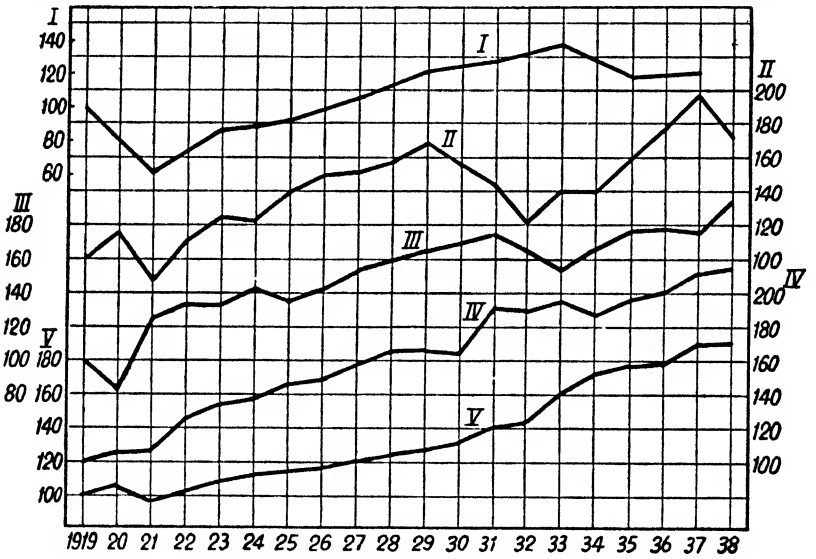
[1] The trend is eliminated by taking the percentage deviations from a second degree parabola fitted by means of the least square method. The equation of the trend is calculated to be: $y = 157{\cdot}77 + 2{\cdot}099x - 0{\cdot}0526x^2$, with the origin at the beginning of 1929 and x in units of six months.

[2] Corresponding to the Census sub-group "paper and pulp" under the industry group "paper, pulp and products."

that prices generally fluctuated to a greater extent than money wages. This is particularly true of the boom in 1920 and the depression in 1921. After 1931, however, the situation is quite different. Changes in money wages nearly always brought about a change in product wages in the same direction. From 1931 to 1938, money wages increased in five years, during which product wages, with trend

CHART XII

PRODUCT WAGE RATES, MAN-HOUR PRODUCTIVITY, RATIO OF MONEY WAGE RATES TO PULPWOOD PRICES, AND GROSS PROFIT MARGIN IN PAPER AND PULP INDUSTRY IN THE U.S.A. (1919–38)



Curve I: Index of gross profit margin.
Curve II: Index of physical output.
Curve III: Index of product wage rates with trend unremoved.
Curve IV: Index of man-hour productivity.
Curve V: Index of the ratio of average hourly money wage rates to pulpwood prices.
For data see Statistical Appendix to Chap. VI, Tables XI and XII, pp. 166–7.

eliminated, increased in four years and fell in only one year. During the same period, money wages decreased in two years, in which product wages also declined. Thus it is prices of products, rather than money wages, that appear to be stickier.

In Chart XII, we relate together the fluctuations in product wages, man-hour productivity of labour, both with trend unremoved, the ratio of money wage rate to raw material prices and the gross

profit margin. It can be seen that on the whole the rate of product wages appears to rise with a trend roughly parallel to that of the man-hour productivity of labour. But again, as is the case with manufacturing industries as a whole as well as with the cotton industry, the fluctuations in the productivity of labour and in the rate of product wages appear to be quite uncorrelated. And there appears to be no correlation between the fluctuations of the man-hour productivity and employment either.

The ratio of money wage rate to raw material price (which is represented here by the average cost of pulpwood per cord, f.o.b. pulp mill, as given in the United States Statistical Abstract) rose rapidly during these two decades. It rose from 100 in 1919 to 281·1 in 1938. It shows, however, very little fluctuation, rising fairly smoothly all the while, with the exception of 1919–21 during which years it fluctuated slightly in the opposite direction to the rate of product wages. It therefore does not help to explain the fluctuations in the latter, which presumably must be accounted for chiefly by the changes in profit margin.

The profit margins in paper industry, however, again can only be reliably obtained for odd years from the Census of Manufactures data.[1] They do not enable us to observe the year-to-year relation between profit margin and product wages. But some influence of the variations in profit margin upon the rate of product wages can be roughly observed from our chart. For example, the big jump in product wage in 1921, when the productivity of labour hardly showed any increase and when money wage rate declined relatively to the price of pulpwood, can be clearly seen to be the result of the drastic drop in profit margin which stood in 1921 forty per cent below the

[1] It is to be noted that the Census of Manufactures separated the industry "Paper and Pulp" into the "Paper" and "Pulp (wood and other fibre)" industries for 1927 and henceforth. This resulted in counting as two establishments each mill which manufactured both paper and pulp and in a duplication in the figures of the gross value of products and the costs of materials, fuel, etc., as combined. Thus the figures after 1927 are not strictly comparable with those for earlier years. Fortunately the Census provides for the year 1927 two sets of figures; one of which counts as a single establishment each mill which manufactured both paper and pulp and thus is comparable with the figures for earlier years, whereas the other is comparable with the later years. Thus the awkwardness of the change in the Census method of division can be largely overcome by calculating the gross profit margin in two sections, then converting them into indices and then joining them together. The resulting series of the index of profit margin would provide an adequate indication of the variations in profit margin, unless the amounts of duplication since 1927 vary considerably from year to year relatively to the gross value of products and costs of materials, fuel, etc., respectively. Since the amounts of duplication in costs of materials, etc., and gross value of products in 1927, as shown by the Census, are only approximately 12·3 per cent and 9·6 per cent of the total prime cost (wage bill plus cost of materials, etc.) and the value of products respectively, a slight variation of the percentages of duplication from year to year is therefore not likely to affect the index of gross profit margin to any significant extent.

level in 1919; and the fall in product wages in 1933, although man-hour productivity was actually higher in that year than in 1931 and the price of pulpwood had fallen a great deal relatively to money wage rate, was again obviously the result of the rise of profit margin, the subsequent decline of which in 1935 appears to have also been the chief cause of the abrupt rise in product wages.

The decline of profit margin in 1921 and its subsequent recovery with the return of good trade in the paper industry appear to be in line with the traditional belief, even though the law of diminishing returns does not appear to be the underlying cause. In the depression of 1930–33, however, gross profit margin, as is the case with manufacturing industries as a whole and the cotton industry, continued to rise in spite of the severe decline in production and employment; whereas the subsequent recovery in production that occurred from 1933 to 1935 was accompanied by a considerable relapse in profit margin. Even at the peak of a new boom in 1937, profit margin, though very slightly increased as compared with 1935, still remained very much below the level it had reached at the bottom of the great depression. Thus after 1929, the actual behaviour of profit margin in the paper industry is again quite different from what the traditional theory would lead us to expect.

Again in this case, an illuminating light is shed upon the behaviour of profit margin by a comparison of the index of unit prime cost with the index of value of product per unit. The index of unit prime cost can be derived by converting the sums of wage bill plus costs of material, fuels, etc., as given by the Census of Manufactures, into an index and then dividing it by the index of physical output of paper and pulp. The index of value per unit of output can be obtained by applying a similar process to the gross values of products as given by the Census.[1] In the table on p. 103, these indices are compared together and with the index of gross profit margin in paper and pulp industry.

As these indices are biennial, they do not reveal the fluctuations between the census years; for example the spectacular rise of the price of paper and the considerable increase, though to a smaller extent, of prime costs in 1920 are not shown. But still significant features can be observed from such comparison. It can be seen that

[1] The difficulty arising from the duplication in gross value of products and costs of materials, etc., due to the counting as two establishments each mill which manufactured both paper and pulp since 1927 is circumvented by computing our indices of gross value of products and of the total prime cost—i.e. wage bill plus costs of materials, etc.—in two sections and then joining them into continuous series. The assumption underlying this procedure is that the amount of duplication in gross value or in total prime cost as a proportion of the gross value or total prime cost respectively does not vary much from year to year. (Cf. footnote 1 on p. 101.)

the unbroken rise of profit margin from 1921 to 1933 was persistently associated with the lag of sales value per unit behind the continuous fall in the unit prime cost. When the unit prime cost turned to rise after 1933, the value per unit of output again failed to offset the rise in prime cost sufficiently at first, with the result that profit margin experienced a considerable narrowing in 1935. During the period

GROSS VALUE AND PRIME COST PER UNIT OF OUTPUT, AND GROSS PROFIT MARGIN IN PAPER AND PULP INDUSTRY IN THE UNITED STATES

Year	Value per Unit	Unit Prime Cost	Profit Margin
1919	100·0	100·0	100·0
1921	97·4	109·2	60·3
1923	91·9	95·9	85·5
1925	89·1	91·8	90·3
1927	87·0	85·9	104·3
1929	83·3	77·9	121·0
1931	68·5	63·0	127·0
1933	58·0	51·6	137·3
1935	64·5	60·9	118·0
1937	71·2	66·6	120·5

from 1935 to 1937, however, prices did rise by much the same proportion as the unit prime cost, but this only meant that gross profit margin did not decline further. It appears, therefore, that as is the case with the cotton industry as well as with manufacturing industries as a whole, the inflexibility of price played an important role in influencing the behaviour of profit margin in the paper industry.

Prior to 1921, however, the case was quite different. The spectacular rise of the prices of paper and pulp at the boom of 1920 was far in excess of both the wage cost per unit of output and the price of pulpwood, and must, therefore, have brought about an enormous increase in gross profit margin. The slump of profit margin in the ensuing depression was even more drastic, since the profit margin in 1921 had fallen to a level nearly 40 per cent below even the level of 1919, let alone in comparison with the boom level of 1920. This indicates that the prices of paper and pulp must have dropped to a far greater extent than the unit prime cost. Thus again the evidence seems to lend support to the popular belief that the price system in American industries has become more inflexible in recent years.

THE IRON AND STEEL INDUSTRY

The iron and steel industry differs from the two previous ones in that it is essentially a capital industry in the sense that its products are in the main ultimately destined to be made into producers' capital

equipment or durable consumers' capital. The production of iron and steel is highly concentrated and the markets for iron and steel products are therefore highly oligopolistic, if not monopolistic. As revealed by the hearings before the Temporary National Economic Committee, ten companies owned 88 per cent of the industry's assets in 1937; four companies owned more than 66 per cent; two companies owned 55 per cent. The United States Steel Corporation alone owned 40 per cent of the total assets of the industry. Productive capacity, in the case of the most important products, is similarly concentrated. Of the capacity to produce steel ingots, United States Steel has 35 per cent, the Bethlehem Steel Corporation, the second largest in the field, has 14 per cent, and the Republic Steel Corporation 9 per cent, the remainder being held by seven other companies no one of which has more than 5 per cent. Of the capacity for hot rolled products, United States Steel has 31 per cent, Bethlehem 13 per cent and Republic 9 per cent, the remainder being divided among seven companies, no one of which has more than 6 per cent.[1] The share of any of these firms may certainly be even larger within the regional markets where it sells. While United States Steel has but a third and Bethlehem but a seventh of the national total capacity, the two companies, according to the testimony of Mr. Grace, president of Bethlehem, before the T.N.E.C., sell in "distinctly different territories."[2]

The domination of the iron and steel industry by a few large firms naturally facilitates tacit understanding and leadership in price policy. As United States Steel is indisputably the giant of the industry, it is also natural that price-leadership should fall upon it. Thus it is the usual practice for the United States Steel Corporation to take the lead in initiating the base prices of the great majority of steel products and for the rest of the industry to follow.[3] The exercise of such leadership has been facilitated by the existence of such trade organization as the Iron and Steel Institute. The general policy of the United States Steel Corporation, as has frequently been expressed by its officials, has been to restrain increases in price during periods of increasing demand and to oppose reductions during periods of decreased demand and in this way to stabilize prices.[4] Various arguments have been adduced to justify this line of policy. For instance, it is argued that since the demand for steel is derived from the demand for commodities which are produced with steel equipment, or which contain elements of fabricated steel, and since the

[1] *Hearings before the Temporary National Economic Committee*, Part 18, pp. 10408–9, and also Wilcox, *op. cit.*, p. 119.

[2] *Hearings before the T.N.E.C.*, Part 19, p. 10590, and also Wilcox, *op. cit.*, p. 120.

[3] Cf. Wilcox, *op. cit.*, p. 124.

[4] Cf. A. R. Burns, *op. cit.*, pp. 85 and 213.

price of steel enters into only relatively small portions of the prices of such goods, the demand for steel products is therefore likely to be very inelastic with respect to changes in prices. Again it has been pointed out that the very heavy overhead costs and the more or less constant marginal prime cost in steel production are particularly likely to tempt the individual producers to underbid each other whenever production falls below the practical capacity of the expensive plant, unless stabilization under price leadership puts a restraint on such cut-throat competition, which in the end would bring prices down to a level barely sufficient to cover direct prime costs.

The most remarkable instance of price stabilization is provided by steel rails. Soon after its formation in 1901, the United States Steel Corporation announced a price of $28 a ton for steel rails and it remained in force from May 1901 until April 1916—i.e. for fully fifteen years. After a number of changes the price of steel rails was again stabilized at $43 a ton from October 1922 to October 1932—i.e. for ten years.[1] Indeed the prices of other steel products have never attained a stability comparable with that in the steel rail market, but statistics show that prices of steel sheets, tank plates, bars, beams, wire and wire nails also showed periods of unchanged price for considerable periods.[2] The Bureau of Labour Statistics wholesale price index of iron and steel shows quite small year-to-year fluctuations since 1923.[3]

Since it is difficult to obtain production and hourly wage data for the entire iron and steel industry, the following statistical study is confined to the "blast furnaces, steel works, and rolling mills" division of the industry—i.e. the Census sub-group "crude iron and steel, and rolled products"—which together accounted for about 70 per cent of the total employment in the entire industry.[4] The accompanying chart relates together the fluctuations in the indices of physical output, the wholesale prices of iron and steel, the average hourly money wages and the average product wage rate (inversed and with trend removed[5]) in blast furnaces, steel works, and rolling mills in the United States. It can be observed that from 1919 to 1930 the fluctuations and turning points of the product wage rate (inverted) do correspond closely with those in the level of physical output. But

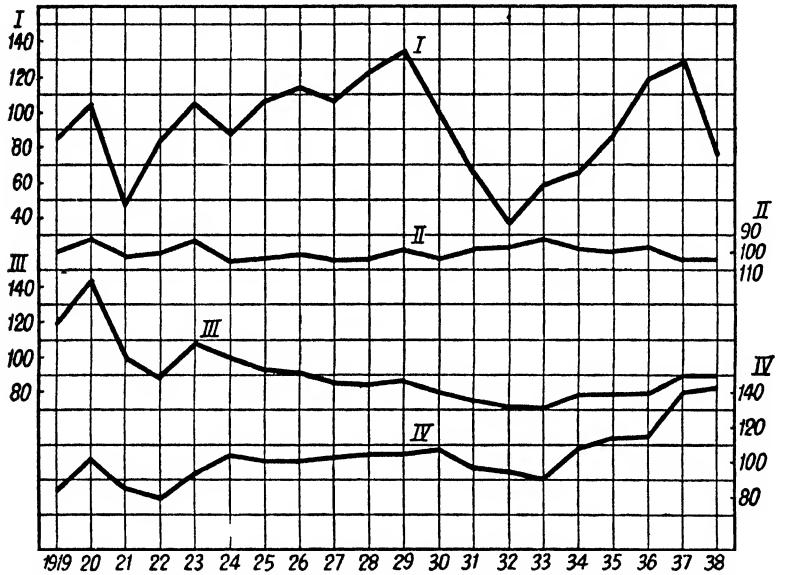
[1] A. R. Burns, *op. cit.*, pp. 205–6.
[2] *Ibid.*, p. 211.
[3] See Statistical Appendix to Chap. VI.
[4] Spurgeon Bell, *op. cit.*, p. 109. For the sake of brevity, we shall refer to "blast furnaces, steel works, and rolling mills" simply as the iron and steel industry hereafter in this study.
[5] The trend is eliminated by taking the percentage deviations from a second degree parabola fitted by means of the least square method. The equation is calculated to be: $y = 169{\cdot}877 + 3{\cdot}033x - 0{\cdot}0334x^2$, with the beginning of 1929 as the origin and x in units of six months.

once more, as is the case with the paper and pulp industry as well as with the manufacturing industries as a whole, what correlation has existed seems to disappear altogether in later years.

As regards the relation between the movements of the prices of products and money wage rates, there appears to be no evidence for the hitherto widely held belief that money wages generally fluctuate

CHART XIII

HOURLY MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES OF IRON AND STEEL, AND PHYSICAL OUTPUT IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS IN THE U.S.A. (1919–38)



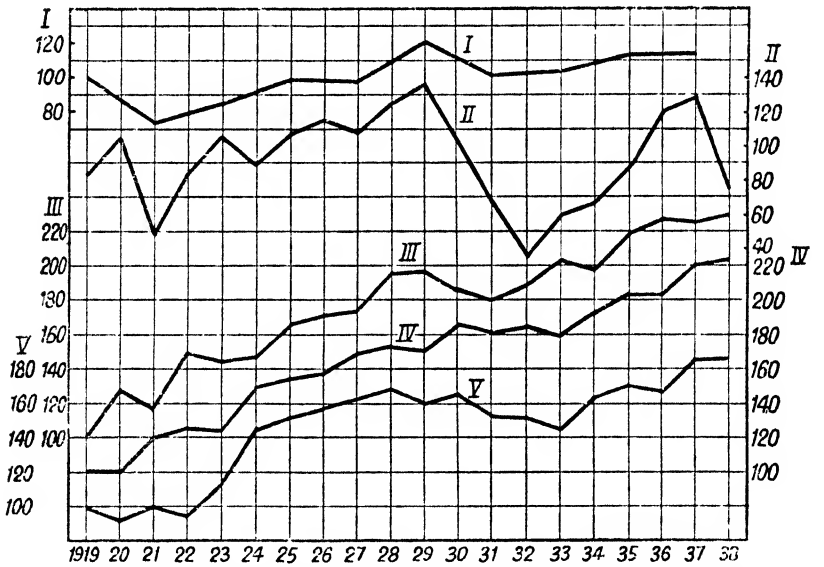
Curve I: Index of physical output.
Curve II: Index of product wage rates with trend eliminated and inverted.
Curve III: Index of wholesale prices of iron and steel.
Curve IV: Index of hourly money wages.
For data see Statistical Appendix to Chap. VI, Table XIII, p. 168.

less in amplitude than prices of the products. Only in the first four years of our period—viz. from 1919 to 1923—do we find a tendency for a change in money wages to be associated with an opposite change in product wages with trend removed. Even during these four years, the rise of money wage rates from 1919 to 1920 was in effect greater than the rise in the wholesale prices of iron and steel. From 1923 to 1930, both prices and wages were fairly stable. While the wholesale prices of crude iron and steel tended to slope gently downward, money

wages tended, if anything, to rise slightly. After 1931, however, money wages generally fluctuated to a greater degree than the prices of the products, with the result that a rise in money wages almost always brought about an increase in product wages with the rising trend eliminated, and a fall in money wages always caused a decline in the latter. Thus, as is the case with the paper industry, there appears

CHART XIV

PRODUCT WAGE RATES, MAN-HOUR PRODUCTIVITY, RATIO OF MONEY WAGE RATES TO PRICES OF IRON ORES AND COKE, AND GROSS PROFIT MARGIN IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS IN THE U.S.A. (1919–38)



Curve I: Index of gross profit margin corrected for overhead labour cost.
Curve II: Index of physical output.
Curve III: Index of man-hour productivity.
Curve IV: Index of product wage rates with trend unremoved.
Curve V: Index of the ratio of money wage rates to prices of iron ores and coke.
For data see Statistical Appendix to Chap. VI, Tables XIII and XIV, pp. 168–9.

to have been an increase in stability of the prices of the products relatively to money wage rates in more recent years.

We shall next compare together the indices of product wage rate (with its trend unremoved), the man-hour productivity of labour, the ratio of money wage rates to the prices of raw materials employed in the production of iron and steel, and the physical output. The

index of the prices of raw materials, used for calculating the ratio of money wage rates to material prices, is, from 1919 to 1935, the weighted average of the indices of the prices of iron ore, coke, and steel scrap as computed by Professor F. C. Mills.[1] It is extended to 1938 by the unweighted average of the Bureau of Labour Statistics price indices of iron ore and coke only. When we compare the year-to-year fluctuations of the ratio of money wages to raw material prices with the fluctuations in product wages, the influence of the former upon the latter is quite obvious. There is a remarkably close correspondence between the movements and the turning points of the ratio of money wages to raw material prices and those of the product wages. This clearly indicates that the variation of raw material prices relatively to money wages is an important factor accounting for the year-to-year fluctuations of the product wage rate. This is quite natural, since material costs are a very important item of the total cost in iron and steel production. As shown by the Census of Manufactures figures, total material cost in blast furnaces, steel works, and rolling mills is generally more than three times as big as the wage bill, and constitutes well over 60 per cent of the total gross value of the products.

As regards the relation between the productivity per man-hour and the product wage rate, here again we find that the upward trends of these two series are practically parallel.[2] But once more we cannot find any positive correlation between the year-to-year fluctuations of man-hour productivity and product wages. In many years, average productivity of labour and product wages actually moved in opposite directions.

One feature which distinguishes the iron and steel industry from the two previous industries we have examined is that the man-hour productivity in this industry appears to be, to some extent, positively correlated with the level of output. From our chart it may be noticed that the average productivity of labour appears to have a tendency to increase with the level of output. This fact seems, at first sight, to be at variance with the conclusion of Professor Yntema's elaborate study of the United States Steel Corporation that the cost function of the said firm is linear.[3] But the difference is only apparent and the two facts are not mutually exclusive. For in iron and steel production there is probably a core of labour input which is of the nature of

[1] F. C. Mills, *Prices in Recession and Recovery*, Appendix V, p. 546.

[2] If we fit a least square straight line to each of these two series, we shall find that the slopes of the two linear trends are practically equal. The equation of the least square linear trend of man-hour productivity is: $y = 176{\cdot}84 + 3{\cdot}02x$, while that of product wage rate is: $y = 165{\cdot}44 + 3{\cdot}03x$, both equations having the beginning of 1929 as the origin and x in units of six months.

[3] *Vide supra*, p. 58, and also *United States Steel Corporation T.N.E.C. Papers*, Vol. I, pp. 223–301.

overhead cost in the sense that if production is to be carried on at all, a certain minimum cadre of labour is indispensable. Thus even if marginal labour cost, or marginal gross productivity of labour, is constant over the relevant range of operation, average labour cost may decline, or average gross productivity of labour may increase, as the output expands, because this overhead labour is then spread out over a larger output. Therefore, increasing average gross productivity of labour is quite compatible with constant marginal labour cost.

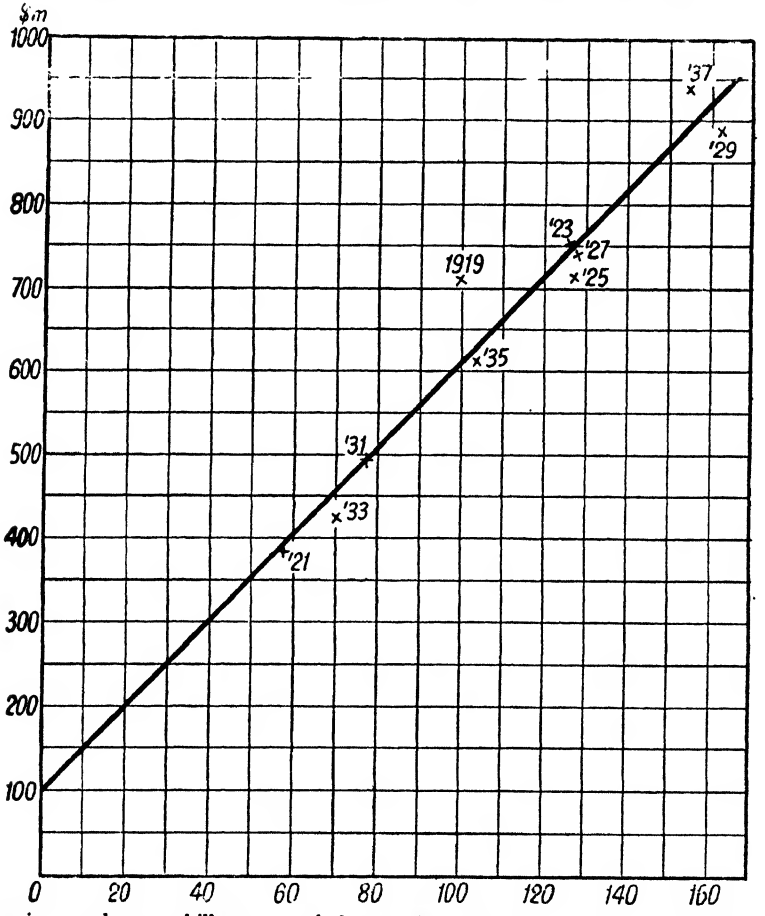
That the marginal gross productivity of labour, or the marginal labour cost under given money wage rate, is in fact more or less constant over the normal range of production, while the average gross productivity of labour is increasing with the output, can be demonstrated roughly in the following way. Let us take the Census of Manufactures figures of wage bills in blast furnaces, steel works, and rolling mills for the census years between 1919 and 1937, and adjust these wage bills to the 1919 level of average hourly money wages by dividing them with the indices of hourly wages for the corresponding years respectively with the year 1919 as base. Then we further correct these adjusted wage bills for changes in average productivity of labour since 1919 due to the secular trend of the improvement in technique by multiplying the wage bills with the indices representing the trend values of average productivity for the corresponding years with 1919 as a base. The trend of average productivity is found out by fitting a least square straight line to the time series of actual man-hour productivity.[1] Then we plot down the final figures of wage bills in a scatter diagram with the index of physical output along the X-axis. It can be seen at a glance that the points are along a fairly straight line. A linear regression line is then fitted to these points by the least square method. It is found that the regression line, which may be supposed to represent roughly the labour cost function within the range of observation (at the 1919 level of money wage rate and the 1919 state of technique), does not pass through the origin. The regression equation is calculated out to be: $y = \$100{\cdot}31$ million $+ \$5{\cdot}11$ million $\times x$. The fact that the scatter points are arranged more or less in a straight line indicates that marginal gross productivity of labour, or marginal labour cost under given wage rates, may be assumed as roughly constant, and the fact that the regression line, which represents the labour cost functions, cuts the Y-axis above zero shows that average labour cost is declining,

[1] As can be seen at a glance from Chart XIV, the actual man-hour productivity does appear to fluctuate round an upward sloping straight line. The equation of the linear trend, as we have found out above, is: $y = 176{\cdot}84 + 3{\cdot}02x$, with the origin at the beginning of 1929 and x in units of six months.

or average gross productivity is increasing, with the expansion of output because of the spreading out of overhead labour.

CHART XV

TOTAL WAGE BILLS AND OUTPUT IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS IN THE U.S.A. (1919–38)



Y-axis: total wage bills corrected for secular trend of man-hour productivity (for method of correction see p. 109).
X-axis: index of physical output.

The presence of considerable fixed overhead labour cost, apart from the variable labour cost, however, would present some difficulty in the calculation of the gross profit margin. If only it can be assumed that the entrepreneurs make no distinction between the invariable

initial labour cost and the subsequent variable labour cost and formulate their price policy on the basis of total labour cost plus material cost per unit of output, then we can still calculate the gross profit margin for the iron and steel industry in the same way as we did for the other industries—viz. by taking the Census figures of wage bills plus costs of materials, fuel, etc., as the total prime costs, and subtracting them from the gross values of products to obtain the gross profits plus overheads, and then dividing the gross profits thus obtained with the respective gross values of products to get the percentages of gross profit margins. The striking feature of the gross profit margins derived in this manner for blast furnaces, steel works, and rolling mills is that, unlike the behaviour of profit margins in the manufacturing industries as a whole and the two industries we have surveyed above, gross profit margins here display a distinct positive correlation with the level of output. This can be readily observed from the following table—

PERCENTAGES OF GROSS PROFIT MARGIN IN COMPARISON WITH OUTPUT IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS IN THE UNITED STATES

Year	Output	Profit Margin per cent	Year	Output	Profit Margin per cent
1919	100·0	16·8	1929	162·3	21·6
1921	57·5	9·5	1931	78·0	15·5
1923	126·5	14·3	1933	70·9	15·6
1925	127·6	16·8	1935	104·1	18·9
1927	128·2	16·5	1937	155·1	20·2

During both the depressions of 1921 and 1931, profit margin calculated in this way declined sharply with output, and in the recoveries that followed, it gradually rose again. All this is exactly what the traditional economic theory would have us to expect for industries under perfect competition; yet the iron and steel industry in the United States is one of the most oligopolistic industries, and the prices of iron and steel products are believed to be among the most stable and rigid of the industrial prices.

As the invariable overhead labour cost is quite considerable in the production of iron and steel, it might be suspected that this positive correlation might be the result of our inclusion of the overhead labour cost into the total variable prime cost. It is quite probable that the producers in iron and steel industry do make a distinction between the fixed overhead labour cost and the variable prime labour cost; since, as the almost universal assumption of linearity in break-even charts and the evidence of the United States Steel Corporation before the Temporary National Economic Committee seem to

indicate, the producers generally believe their prime cost per unit to be more or less constant in spite of the fact that the statistics of average labour cost exhibit a distinct negative correlation with the level of output in our present case. When the average labour cost is falling, as it is with the iron and steel industry, marginal labour cost, whether it is constant or not, multiplied by the quantity of output must needs be smaller than the total wage bill. In other words, total wage bill cannot be covered by charging to each unit of output the marginal labour cost. The residue must then be covered by, and included in, the gross profit. It might be questioned whether it is not the exclusion from gross profit of the residue of the total wage bill, that cannot be covered by allotting to each unit of products the marginal labour cost, in our calculation of the gross profit margin that causes the prominent positive correlation between the profit margin and the level of output. For given the money wage rates and the state of technique, the residue of the total wage bill—I shall hereafter call it the residual overhead labour cost[1]—is independent of the volume of production so long as the marginal gross productivity of labour or the marginal labour cost is constant. This can be readily observed from the diagram. Thus when the volume of output declines to a low level, the residual overhead labour cost would bulk large in the total gross profit including overheads. Conversely when output is large, the residual overhead labour cost would constitute only a small part of the total gross profit. Therefore the exclusion of the residual overhead labour cost from the gross profit would tend to make the percentage profit margin increase with an expansion of output and decrease with a contraction of output.

It is interesting, therefore, to see how the gross profit margin in the iron and steel industry would behave if we eliminate the residual overhead labour cost from the total wage bill and add it to the gross profit. There are, of course, no available statistics showing directly the amount of the residual overhead labour cost for each year, but it can be roughly estimated in the following manner. If the linear regression line in our preceding diagram—at least that section of it that represents the normal range of production—can be regarded as roughly representing the labour cost function under given state of technique and given money wage rate, then the distance between the origin and the point at which the regression line cuts the Y-axis may be regarded as the residue of the total wage bill that cannot be covered by charging the marginal labour cost to each unit of output —viz. the residual overhead labour cost, which we must now try to

[1] This residue is not necessarily identical with the entire overhead labour cost. It is equal to the latter only when the linearity of labour cost function, or the constancy of marginal labour cost, applies from the zero output onward.

exclude from the prime cost and add to the gross profit. Thus the 100·3 million dollars, as indicated in the above diagram and by the regression equation, may be considered as a rough estimate of the residual overhead labour cost for the year 1919. And the estimates of the same for other census years can be derived by multiplying the 1919 figure with the index of hourly money wage rates for the year concerned, with 1919 as the base year, and then dividing it with the index of the trend value of man-hour productivity for the year concerned, again with 1919 as 100. (It is assumed that increase in man-hour productivity of labour due to the secular trend affects the marginal and overhead labour equally so that the labour cost function is shifted down bodily in proportion to the increase in the trend value of man-hour productivity. This has been our assumption underlying the derivation of the labour cost function for the year 1919 in the preceding chart.) The figures calculated out are as follows—

Residual Overhead Labour Cost in Blast Furnaces, Steel Works and Rolling Mills in the United States
(in million dollars)

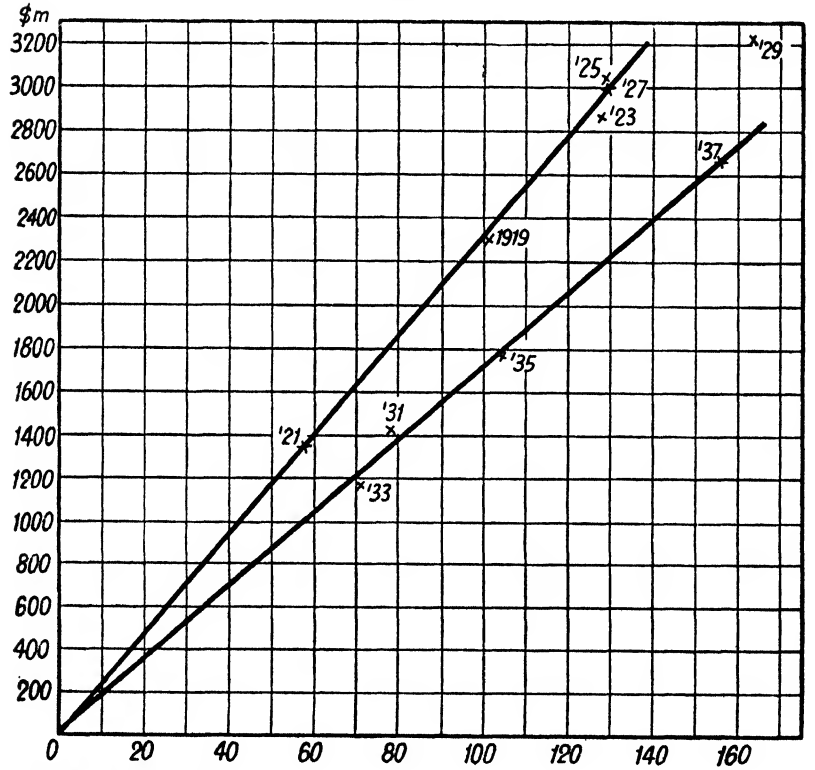
1919	100·3	1929	82·7
1921	91·7	1931	72·2
1923	92·7	1933	63·4
1925	92·6	1935	74·8
1927	87·0	1937	82·1

It might be interesting also to know whether there is similarly a part of the costs of materials, fuel, etc., which ought to be regarded as overhead and added to the gross profit instead of being included as prime cost. We have therefore applied the similar procedure of estimating the residual overhead to the Census figures of costs of materials, fuel, etc. These figures are first corrected for changes in the prices of the materials as represented by the index of the average prices of iron ore and coke (and up to 1935 also steel scrap) with 1919 as the base year. Then we plot down the corrected figures against the index of physical output in a scatter diagram with the latter measured along the X-axis. It can be readily seen that the points are arranged along two separate lines. The five consecutive points for the years 1919–27 form one line, and the four consecutive points for the years 1931–37 constitute another with a smaller slope; while the point for 1929 seems to fall in between these two lines. It appears to indicate that there might have occurred a change in the technique of production during the years 1927–31, which has effected a considerable saving in materials, and the year 1929 represents a transitional stage. On the strength of Professor Yntema's conclusion

of linear cost function, we fit a linear regression line to each of the two groups of points. It is found that the regression line of the first group of points practically passes through the origin, while the second regression line cuts the Y-axis at a point very close to the origin.

CHART XVI

COSTS OF MATERIALS, FUEL, ETC., AND OUTPUT IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS IN THE U.S.A. (1919–38)



X-axis: index of output.
Y-axis: costs of materials, fuel, etc., in blast furnaces, steel works, and rolling mills (from the Census of Manufactures).

The regression equation for the first five years—i.e. 1919, 1921, 1923, 1925, and 1927—is: $y = \$4{\cdot}8$ million $+ \$23{\cdot}26$ million $\times x$; and that for the last four years—i.e. 1931, 1933, 1935, and 1937—is: $y = \$29{\cdot}5$ million $+ \$16{\cdot}9$ million $\times x$. These equations are, of course, not very reliable, because the number of instances on which

they are based are too few to warrant any close estimation. But the residual overhead material costs shown in both these equations, though rather divergent, are both very small relatively to the magnitude of total material costs and also relatively to the total gross profit, which was 610·1 million dollars in 1919 as calculated directly from the Census data and 710·4 million dollars when the estimated residual overhead labour cost was added. It may, therefore, be concluded that the residual overhead material cost, if it exists at all, is not likely to be a significant proportion of the total gross profit including all overheads, and that its exclusion from the gross profit would not be likely to affect the direction of the movement of the percentage gross profit margin. We shall therefore neglect this problem and continue to regard the whole costs of materials, etc., as variable prime cost which is constant per unit of output.

When we have added our estimates of the residual overhead labour costs to the gross profit figures, the percentages of gross profit margin become as follows—

GROSS PROFIT MARGIN CORRECTED FOR RESIDUAL OVERHEAD LABOUR COST IN COMPARISON WITH OUTPUT IN BLAST FURNACES, STEEL WORKS AND ROLLING MILLS IN THE UNITED STATES

Year	Profit Margin in percentages		Index of Output
	Uncorrected	Corrected	
1919	16·8	19·6	100·0
1921	9·5	14·3	57·5
1923	14·3	16·5	126·5
1925	16·8	19·2	127·6
1927	16·5	18·9	128·2
1929	21·6	23·6	162·3
1931	15·5	19·7	78·0
1933	15·6	20·2	70·9
1935	18·9	22·1	104·1
1937	20·2	22·2	155·1

It can be observed that although the profit margin is increased all round and the amplitude of its variations is reduced to some extent, it still seems to be positively correlated with the level of output. It declined considerably during the depressions of 1921 and 1931, and gradually rose with the recoveries in production that followed. The peak of production in 1929 was reflected in a similar peak in profit margin, though the very big increase in output between 1935 and 1937 was hardly accompanied by any increase in the latter. Thus, strangely enough, the behaviour of profit margin in the iron and steel

industry—i.e. blast furnaces, steel works, and rolling mills—where production is practically controlled by a few giant firms and where stable prices appear to be the deliberate policy, is closely in conformity with the conventional view, the reasoning of which is largely based on the assumption of perfect competition.

Such behaviour of the profit margin makes it rather questionable whether the prices of iron and steel, in spite of their apparent stability, could really be regarded as inflexible according to our own previous criterion. If the prices of iron and steel are really inflexible according to our definition, would not a drop in unit prime cost, which generally occurs in depressions, be accompanied by a rise in profit margin, and a rise in unit prime cost with a fall in profit margin? In the following table we compare the index of unit prime cost in blast furnaces, steel works, and rolling mills, both before and after the deduction of the residual overhead labour cost, with the value per unit of output and the profit margin. It can be observed that falls in unit prime cost (whether corrected or not) were frequently accompanied by even greater reductions in sales value per unit so that profit margin declined, as in 1921, 1927, 1931.

GROSS VALUE AND PRIME COST PER UNIT OF OUTPUT IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS IN THE UNITED STATES

Year	Value per Unit	Unit Prime Cost in percentages		Profit Margin in percentages	
		Uncorrected	Corrected	Uncorrected	Corrected
1919	100·0	100·0	100·0	16·8	19·6
1921	91·3	99·7	97·2	9·5	14·3
1923	90·8	93·6	94·3	14·3	16·5
1925	80·3	80·3	80·6	16·8	19·2
1927	75·1	75·4	75·7	16·5	18·9
1929	70·4	66·4	66·9	21·6	23·6
1931	60·6	61·7	60·6	15·5	19·7
1933	52·9	53·6	52·5	15·6	20·2
1935	61·1	59·7	59·3	18·9	22·1
1937	71·2	68·4	68·9	20·2	22·2

And the only two instances of rising unit prime cost in our table—viz. 1935 and 1937—were both associated with even greater rises in the value per unit so that profit margin increased instead of declined. There has been no such persistent tendency for prices to offset insufficiently the changes in unit prime cost, as we have observed above in the later years of our period studied in the cases of cotton and paper and pulp industries as well as in manufacturing industries as a whole. Thus the apparent stability of the prices of crude iron and steel as a whole cannot be attributed to the rigidity or inflexibility of price

policy in our sense. Rather it seems to be chiefly the result of the stability of their prime cost of production.

Summary

The findings of this chapter may be summarized as follows—

1. The behaviour of the average gross profit margin in manufacturing industries as a whole observed in the previous chapter cannot be accounted for by the cyclical changes in the relative volumes of output of consumers' goods and capital goods alone. The effect of such shifts in weights as might take place during the business cycles is probably rather insignificant, since the difference between the average gross profit margin in capital goods industries and that in consumers' goods industries is rather small.

2. There is observable a certain vague negative association between product wage rate and the level of employment or output in all the three industries examined for certain parts of the period 1919–38. In the cases of paper and iron and steel industries, the negative correlation is observable in the earlier part of the period, as is also the case with manufacturing industries as a whole; with the paper industry, the correlation is observable up to 1928, while with the iron and steel industry the correlation ceases to exist only after 1931. In the case of the cotton industry, however, the negative correlation between product wage rate and output appears particularly close after 1928; whereas from 1923 to 1928 the fluctuations of output seem to have no effect on product wage rate.

3. In all the three industries, man-hour productivity does not seem to be correlated in any way with product wage rate in the respective industry. In the cotton and paper industries, man-hour productivity is quite irregular, bearing no correlation with output or employment in the same industry either. In the iron and steel industry, however, a certain degree of positive correlation is observable between man-hour productivity and output. This, as we have shown, is due to the fact that in iron and steel production there is a considerable amount of labour which is of the nature of invariable overhead input. The marginal gross productivity of labour in the iron and steel industry, however, at least within the range of production observed, appears to be more or less constant.

4. The variations of raw material prices relatively to money wage rates appear to have an obvious and important influence on the year-to-year fluctuations of product wage rates in the cotton and iron and steel industries. In the paper and pulp industry, however, the ratio of money wage rates to raw material prices as represented by the prices of pulpwood, which was rising fairly smoothly without much

fluctuation, does not seem to have exerted much influence on the fluctuations of product wage rates.

5. The profit margins in the three industries studied showed quite a different pattern of behaviour from each other. In the paper industry, the general pattern of the movement of gross profit margin is more or less similar to that of manufacturing industries as a whole. It dropped considerably in the slump of 1921 only to rise again steadily during the twenties. But during the Great Depression, it continued to rise, relapsing to a lower level only during the following recovery. In the cotton industry, the pattern is somewhat different. The profit margin there also declined in 1921, but the lowest point was not reached until 1925, when the output was fairly high. In 1931 profit margin also increased in spite of the slump of output and in 1933 it declined again, though production increased considerably. However, except during the periods 1921–23 and 1929–33, profit margin and output in the cotton industry had always moved in the same direction. In the iron and steel industry, there appears to be a quite definite positive correlation between profit margin and output, whether we include the estimated residual overhead labour costs in the gross profits or not. The profit margin dropped markedly during both depressions and rose with the ensuing recoveries.

6. In the cotton and paper industries, the inflexibility of prices—i.e. the tendency of prices offsetting insufficiently the changes in unit prime cost—appears to have played an important role in determining the movement of profit margin, as we have already observed in the manufacturing industries as a whole. In the cotton industry, the tendency for prices to be inflexible has been persistent since 1925; while in the paper industry prices have tended to be inflexible ever since 1923. In the iron and steel industry, however, in spite of the extraordinary stability of the prices of some of its products, no such persistent tendency for prices to offset insufficiently changes in unit prime costs can be observed for this industry as a whole over the whole period studied.

CHAPTER VII

REAL WAGES AND THE RICARDO EFFECT

HAVING examined the actual behaviour of real wages and profit margins in the manufacturing industries, we shall now turn to the next task which we have set ourselves—viz. to review Professor Hayek's trade cycle theory in the light of our statistical findings. Before we do this, however, we must first discuss briefly the theoretical controversy that has been waged around his theory.

In an essay entitled "Profits, Interest and Investment,"[1] Professor Hayek has made a further development in his theory of trade cycles, in which he shows that a high level of consumption will, after a certain point, reduce the rate of investment, not because it raises the market rate of interest, but because it lowers the demand for investible funds. "Under certain conditions," he writes, "contrary to a widely held opinion, an increase in the demand for consumers' goods will tend to decrease rather than to increase the demand for investment goods."[2] His argument is based on a revival of the Ricardian proposition that a rise in real wages will encourage entrepreneurs to substitute machinery for labour and consequently adopt a more roundabout method of production, and vice versa. Taking for granted that during the upswing phase of the trade cycle prices of finished products would rise continuously relatively to money wages and real wages would consequently decline, he contends that although the expansion of effective demand during the upswing would induce an increase in investment expenditures for the purpose of widening the capital structure according to the Acceleration Principle, the increase in investment expenditure due to this cause would sooner or later be offset by the tendency to shift to less capitalistic methods of production because of the continuous fall in real wages. Once the expansion of investment expenditure and effective demand come to an end, the investment demand for widening purpose will disappear altogether, and the boom will collapse and a cumulative downswing begin. The decline of income will ultimately be halted at a level where the propensity to save is so much reduced that the decline in the *ex ante* savings catches up with the decline in investment expenditure. When the level of income ceases to fall, and the stock of capital equipment is gradually reduced through non-replacement of capital depreciation, sooner or later the requirement of replacement will arise and gross

[1] The first essay in the volume of collected essays entitled *Profits, Interest and Investment.*

[2] *Op. cit.*, p. 3.

investment will begin to revive. Meanwhile, what is more important according to Professor Hayek, the high level of real wages at the bottom of a slump will induce the entrepreneurs to introduce more labour-saving, or more durable, machines, and thus bring about further revival in investment expenditure. Thus income would begin to rise and the cumulative process of expansion would start all over again, until it is again checked by the Ricardo Effect of the falling real wages.

This, in brief, is Professor Hayek's new explanation of the cyclical industrial fluctuations in a nutshell. We shall leave for the moment the question whether the factual assumption about the behaviour of real wages, on which his theoretical argument is based, is warranted or not, and concentrate on the theoretical foundation of his theory, viz. the "Ricardo Effect." In the essay we have mentioned above, the theorem of the Ricardo Effect is first expounded in real terms—viz. in terms of labour invested for different periods of time—perhaps with a view to show that his theory is directly developed from the Ricardian doctrine that "machinery and labour are in constant competition, and the former can frequently not be employed until labour rise."[1] We can best reproduce Professor Hayek's theory by quoting directly from his essay—

"Assume that the labour used directly or indirectly (in the form of machinery, tools, raw materials, etc.) in the manufacture of any commodity is applied at various dates so that Ricardo's 'time which must elapse before the commodity can be brought to the market' is two years, one year, six months, three months, and one month respectively for the various amounts of labour used. Assume further that the rate of interest is 6 per cent and that in the initial position the per annum rate of profit on the capital invested in the various kinds of labour is equal to the rate of interest. Assume then that while wages remain constant the price of the product rises by 2 per cent (which means that real wages fall in proportion). The result of this on the rate of profit earned on the various kinds of labour is best shown by the table on p. 121.

The amount of profit earned in the turnover of any amount of labour will be equal to the difference between the wages and the price of the marginal product of that labour. If the price of the product rises this will increase the amount of profit on each turnover in a corresponding proportion irrespective of the length of the period of turnover; and the time rate of profit will be increased accordingly much more for labour invested for short periods than on labour invested for long periods. This will, of course, create a tendency to

[1] Ricardo, *The Principles of Political Economy and Taxation*, Chap. XXXI, p. 270 Everyman Edition.

use proportionately more of the latter kind and less of the former kind of labour—i.e. more labour in the last stages of the process and less in the form of machinery or for other work of preparatory character—till by a fall of the marginal product of the former and a rise of the marginal product of the latter kind of labour the time rates of profit earned on capital invested in each become once more the same. Or in other words, a rise in the price of the product (or a fall in real wages) will lead to the use of relatively less machinery and other capital and of relatively more direct labour in the production of any given quantity of output."[1]

	Labour invested for				
	2 years	1 year	6 months	3 months	1 month
Initial amount of profit on each turnover in per cent . .	12	6	3	1·5	0·5
	(all corresponding to 6 per cent per annum)				
Add 2 per cent additional profit on each turnover due to rise of price of product . . .	14	8	5	3·5	2·5
	which corresponds to a per annum rate of profit of (in per cent)				
	7	8	10	14	30

It appears that Professor Hayek meant that this process applies both macroscopically to the economic system as an integrated whole and microscopically within the individual firms. In view of Professor Hayek's usual stress on methodological individualism in economic analysis, one might expect that his emphasis would be on the latter application of the Ricardo Effect. If so, one might query why it is necessary to make the assumption that the individual firms think and plan their investment in terms of labour, which lends the whole theory a rather unrealistic air. In a later article—viz. "The Ricardo Effect"[2]—however, Professor Hayek made it quite explicit that the Ricardo Effect operates primarily within the individual firms, and explained its mechanism more realistically in terms of money capital. A rise in the price of the product, with costs of production remaining the same, will raise the rates of profit on each turnover of the various components of the firm's capital by the same proportion, irrespectively of the length of their periods of turnover. But the time rate of profit will be increased accordingly by a much greater percentage for capital funds invested for a short period of turnover—e.g. the working capital invested in current wages—than for capital invested for long periods —e.g. in heavy machinery and buildings, etc. Thus it is argued that

[1] *Op. cit.*, pp. 8–10.
[2] Hayek, "The Ricardo Effect," *Economica*, May, 1942, pp. 127–52.

a rise in product price relative to money wages, or a fall in real wages, will induce the firm to invest its liquid capital including amortization funds relatively more on those investments which turn over quickly than on investments with a low rate of turnover. When the prices in most industries rise relatively to the corresponding rates of money wages, as Professor Hayek assumes will generally occur during the upswing, the average period of turnover of the gross investment expenditures of the economic system as a whole will therefore decline.[1]

When the Ricardo Effect is understood to operate in this way—i.e. as the influence of real wages upon the choice on the part of each individual firm as between expending its liquid funds on working capital and expending them on fixed capital—it is easy to dispose of the criticism levelled against it by Dr. Wilson and Mr. Kaldor that the average periods of turnover of capital open to the choice of a typical entrepreneur in the real world are more likely to be measured in years, instead of ranging from one month to two years as given in Professor Hayek's example. According to them, if we take the investment periods of say, two, three, or four years, a rise in prices of 2 per cent will only raise the annual rates of profit from 6 per cent on all methods to 7, 6·6 and 6·5 per cent respectively. The importance of the effect of a fall in real wages on the rates of profit, they allege, is therefore much exaggerated by Professor Hayek through his choice of an unrealistic example.[2] But as Professor Hayek points out in reply, the Ricardo Effect operates not only between firms, but within each individual firm, and thus affects the rates of profit on different items of the investment expenditures of each single firm, the periods of turnover of which certainly range from a few months, as in the case of working capital, to several years, as in the case of heavy equipment and buildings. It may be true that the average period of turnover of the entire capital structure of a firm (and even more so of the community as a whole) can only be changed gradually over a long period of time. But this is not the point. What Professor Hayek's theory of trade cycle is interested in is not the average period of turnover of the entire existing capital structure of a firm or of the community, but the period of turnover of the current gross investment expenditures, which determines that vital coefficient that he dubbed the "multiplier of the Acceleration Principle." And common experience suggests that this latter period of turnover can certainly be varied to a considerable degree in the short period according as the firms alter the relative rates at which they will expend their current outlay on renewing and/or adding to their working and fixed

[1] *Ibid.*, pp. 132–8.

[2] Wilson, *Fluctuation in Income and Employment*, Chap. VI, pp. 48–9, and also Kaldor, "Professor Hayek and the Concertina Effect," *Economica*, November, 1942, p. 374.

capital. In the extreme case, it is quite conceivable that a firm may temporarily discontinue all its demand for machinery and yet for a considerable period continue to increase its output and thus add to its working capital.[1] Therefore the above criticism raised by Dr. Wilson and Mr. Kaldor is rather off the point.

The second objection to the theory of the Ricardo Effect put forward by Mr. Kaldor and Dr. Wilson is that with a perfectly elastic supply of credit to each individual firm—i.e. with constant marginal cost of borrowing to each firm—the method, or the capital intensity, of production is independent of the level of real wages or the cost-price relationship.[2] This criticism is directed against Professor Hayek's earlier version of the theory, according to which the Ricardo Effect would operate even if the rates of interest (presumably the rates prevailing on the market) are kept constant and there is no change in the relative prices of labour and capital goods of various sorts.[3] Mr. Kaldor and Dr. Wilson's argument may be briefly summarized as follows. It is pointed out that Professor Hayek's example merely shows that a rise in the price of product relatively to the costs of production will have the effect of raising the marginal rates of profit on investments of shorter periods of turnover relatively more than on investments of longer periods of turnover, at the original margin of production. But this does not necessarily imply that the entrepreneur concerned will therefore increase the investment expenditures of shorter periods of turnover proportionately more than he will increase the investments of longer periods. For, if the entrepreneur attempts to maximize his aggregate net profit, he must endeavour to employ the different factors (assuming that they are perfectly divisible) in such a proportion that the ratio between the marginal physical products of any two factors, or the marginal technical rate of substitution between the two, is equal to the ratio between the marginal costs of these factors for the same period of time. For the sake of simplicity, let us take direct labour and machinery to represent investments of different periods of turnover. Then the entrepreneur will always attempt to employ labour and machinery in such a combination that the ratio between their marginal physical products is equal to the ratio between the annual cost of an extra unit of labour and the annual cost of an extra unit of machinery. If money wages and money rate of interest are assumed to be constant and there is no monopsony either in the labour or in the machinery market, then the marginal annual cost of labour is simply the wage rate, and the marginal annual cost of machinery consists of the

[1] Cf. "The Ricardo Effect," p. 134 footnote, and pp. 135–6.

[2] *Vide* Kaldor, "Capital Intensity and the Trade Cycle," *Economica*, February, 1939, pp. 49–50, and Wilson, *op. cit.*, pp. 51–5.

[3] Cf. *Profits, Interest and Investment*, p. 5 and pp. 32–3.

interest charge on the capital value per unit of machinery plus the annual depreciation charge. Obviously, if the rate of interest to the entrepreneur and the relative prices of labour and machinery are assumed to remain unchanged, the ratio between the marginal costs of labour and machinery cannot change. Therefore the entrepreneur has no incentive to alter the former ratio either—i.e. the ratio between the marginal physical products of labour and machinery. Now suppose the technical production function expressed as a function of the two variables, labour and machinery, is linear and homogeneous —in other words, there are constant returns to scale—the ratio between the marginal physical products of labour and machinery is independent of the scale of production or the absolute amount of the inputs of direct labour and machinery, but is determined entriely by the proportion between the two factors. Therefore so long as the rate of interest to the entrepreneur concerned and the relative prices of labour and machinery remain unaltered, the scale of output of the firm may expand because of a rise of the product price relative to costs, but it will not affect the optimal combination of labour and machinery. In other words, a fall in real wages will only change the scale of output but leave unchanged the capital intensity. It is only when we have particular reason to expect that the production function of these two variables is non-homogeneous in such a manner that an expansion of the scale of output will change the proportion between direct labour and machinery, at which the marginal rate of substitution will remain constant, in favour of direct labour—or in other words that a proportionate increase in both direct labour and machinery will alter the marginal rate of substitution between them in favour of the former—that the firm will employ a smaller proportion of machinery when it expands its output after a rise in the price of its product relatively to the labour cost. As there is no prima facie reason why the production function should assume such special shape, Dr. Wilson therefore contends that Professor Hayek's proposition that even with a given rate of interest a fall in real wages will lead to the adoption of less roundabout methods is rather untenable.

In reply to this criticism, Professor Hayek retorts in his article "The Ricardo Effect" that even though the market rate of interest is given, the assumption of perfectly elastic supply of credit to each individual firm is an unrealistic and irrelevant one. He points out that the condition of perfect competition is not applicable to the credit market, "because successive (additional) loans to the same borrower will never represent the 'same commodity' in the sense in which the term is used in the theory of competition. While in a commodity market 'perfect competition' means that any single buyer can buy at the given market price any quantity he likes, it would, of

course, be absurd to assume that even in the most perfectly competitive money market every borrower (or, for that matter, any borrower) can at the given rate of interest borrow any amount he likes. This is precluded by the fact that in given circumstances the security a borrower has to offer is not as good for a large amount as for a small one. In consequence, every prospective borrower will have to face an upward sloping supply curve of credit."[1]

Now the critics—viz. Mr. Kaldor and Dr. Wilson—both agree that if the supply curve of credit is rising, an increase in product price relatively to costs will tend to induce the firm concerned to adopt less capitalistic methods.[2] But the issue is not thus settled. For the term "rising supply curve of credit" to the individual firms has been used rather ambiguously. It can be interpreted in two quite different senses, and according to which of the two meanings is regarded as the relevant one in the real world, the significance of the Ricardo Effect will be profoundly different. On the one hand, an upward sloping supply curve of credit might be understood as a condition, under which if a firm intends to increase its total stock of capital at any moment of time, irrespectively of the rate of increase, it will have to face a higher marginal cost of borrowing (including subjective risk premium). In other words, the term rising supply curve of credit may denote that the marginal rate of interest to a firm is an increasing function of the total amount of capital invested, and that any expansion of the total capital of the firm, regardless of the rate at which the stock of capital is increased, will raise the marginal rate of interest to the firm. On the other hand, rising supply curve of credit might be interpreted in the sense that the marginal rate of interest is an increasing function of the rate of investment expenditure per unit of time, irrespective of the total stock of capital already invested. Both Mr. Kaldor in his article "Capital Intensity and Trade Cycle" and Professor Hayek in the essay on "Ricardo Effect" appear to use the term rising supply curve of credit in the first sense. For Mr. Kaldor in the above-mentioned article regards the rising supply curve of credit as the limiting factor of the scale of production of the firm, but not of the rate of expansion of the firm's capital stock or the rate of investment.[3] Professor Hayek also uses the term essentially in the same meaning, although he has taken care to add that the supply curve of credit in such sense is fixed only in the short period and is constantly shifted to the right during the upswing.[4] But Dr. Wilson and Mr. Kaldor in his later article

[1] "The Ricardo Effect," p. 138.

[2] *Vide* Kaldor, *loc. cit.*, pp. 45–6 and 53, and also "Professor Hayek and the Concertina Effect," *Economica*, November, 1942, p. 376. Also Wilson, *op. cit.*, p. 55.

[3] "Capital Intensity and The Trade Cycle," p. 47.

[4] "The Ricardo Effect," p. 139 and footnote.

"Professor Hayek and the Concertina Effect" appear evidently to use the term rising supply curve of credit in the second sense, when they contend that the capital intensity will be reduced only if the marginal cost of borrowing has risen, and the marginal cost of borrowing will only rise when the rate of investment has gone up.[1]

It is easy to see that the interpretation of the upward sloping supply curve of credit will have a profound effect upon the working of the Ricardo Effect. For if the second meaning of the term is applicable to the real world—i.e. if the marginal cost of borrowing is an increasing function of the rate of investment expenditure—then, as shown by Dr. Wilson and Mr. Kaldor, the reduction in capital intensity can never offset the investment demand for widening and bring about a fall in the total investment expenditure, for the simple reason that capital intensity will not be reduced unless the rate of investment increases. Furthermore, it will be by no means certain that the Ricardo Effect will work at all—i.e. in the sense that any rise in the price of the product relative to the cost will tend to lead to a reduction of the capital intensity. For with a rising supply curve of credit in this sense, capital intensity will only be reduced if the rate of investment expenditure and marginal cost of borrowing has increased. In the case where the price of the product continues to rise relatively to cost but the rate of investment expenditure stimulated by the increase in demand is not bigger than previously, then the marginal cost of borrowing in the new situation will not rise and hence capital intensity will not be reduced, although real wages continue to fall.

If, on the other hand, the rising supply curve in the first sense is true in the real world—i.e. if the marginal cost of borrowing (including subjective risk) increases with every addition to the total capital of the firm irrespective of the rate of expansion or the rate of investment expenditure—then it is true that every stimulus to expand the firm's total capital, due to a fall in real wages, will be followed by a reduction in capital intensity. And it would then be quite possible for the operation of the Ricardo Effect—i.e. the reduction of capital intensity —to offset the investment demand for widening and bring about a fall in the rate of investment expenditure, as Professor Hayek's theory suggests.

Thus we can readily see that the supply condition of credit to the individual firm has a profound effect upon the significance of Professor Hayek's theory. We must now go into the question what its general nature is likely to be for a typical firm in the real world. Suppose a firm operates with a given amount of its own entrepreneurial capital. As long as its own capital remains the same, it is reasonable to assume that the marginal cost of borrowing to the firm will on the whole

[1] Wilson, *op. cit.*, p. 55 and 58, and Kaldor, *loc. cit.*, p. 376.

increase with the total amount of capital invested. This is because, firstly, with a given amount of own capital, the security which the firm has to offer is not as good for a large loan as for a small one. As Professor Hayek and Mr. Hawtrey point out,[1] the lenders will rely primarily on the value of the business as a going concern for their security, and will be unwilling to lend to any firm more than a given proportion of its own capital. Secondly, as Dr. Kalecki has shown,[2] there is the increasing subjective risk accompanying the increase of indebtedness relative to the firm's own capital. For the greater the borrowed capital relative to the firm's own capital, the greater is the reduction of the entrepreneur's income from his own capital when the average rate of profit falls short of the rate of interest. Loans will take precedence of his own claims on the gross income of the firm and in case of liquidation. If the firm's requirement of capital begins to reach the limits set by the security provided by the firm's own capital and its value as a going concern, the supply curve of credit to the firm in our first sense is likely to rise steeply into what Mr. Hawtrey dubs a "vertical wall."[3] It is true that as business activity increases and general prospects become better, such supply curves of credit which all firms face will be shifted somewhat to the right and all firms may be able to borrow more in proportion to their own capital. But as Professor Hayek points out, the improved expectation of profits will generally increase the amounts the firms would like to borrow still more and thus bring the firms to face higher marginal cost of borrowing than previously.[4] Therefore the fact that an improvement in prospects may shift to the right the supply curve of credit to the firm even if its own capital is unaltered is not likely to modify the legitimacy of the assumption that the marginal cost of borrowing to a firm will increase with the total capital invested as long as the firm's own capital is given. We have already seen above that under such condition, an increase in product price relative to costs that stimulates any positive net investment would tend to reduce capital intensity, irrespectively of the rate of investment, and that it would be possible for the reduction in capital intensity, or in the period of turnover of the investment, to offset the investment demand for widening and to decrease the rate of investment expenditure.

However, is it realistic to assume that the firm's own capital does not change during the trade cycle? Common experiences show that the answer must be negative. For the own capital of a representative

[1] Hayek, "The Ricardo Effect," p. 139, and Hawtrey, "The Trade Cycle and Capital Intensity," p. 6.

[2] Kalecki, *Essays in the Theory of Economic Fluctuations*, fourth essay, "The Principle of Increasing Risk," pp. 98–102.

[3] *Loc. cit.*, p. 6.

[4] *Ibid.*, p. 140.

firm is constantly added to, during the upswing at least, by the ploughing back of undistributed profits and possibly also by the recruitment of additional share capital. If a firm's requirement for investible funds for the purpose of replacement and additional investment does not exceed its retained profits plus depreciation and depletion funds, then obviously the condition of rising supply cost of credit does not apply. For in that case, the rate of interest on these investible funds is simply what the firm would otherwise obtain if it invested its own surplus funds on some readily marketable assets, the yield of which is generally independent of the firm's individual action. Thus with each accumulation of retained net profit, the supply curve of capital in our first sense is shifted bodily to the right.[1] And it will be shifted not merely by the distance representing the amount of the firm's savings out of net profit, but will be shifted more than that distance. For the credit accommodation which a firm can obtain under given circumstances is proportional to its own capital. An increase in its own capital would therefore increase the credit it can raise at more or less the same cost of borrowing. Furthermore, the subjective risk of indebtedness or what Dr. Kalecki terms "commitments" will be reduced all along the curve. For, as Dr. Kalecki has shown, the risk of "commitments" is an increasing function of the ratio of "commitments" to the own capital of the firm.[2] In this respect, each addition to the firm's total investment by the issue of new share capital in the preceding period would have the same effect, though the issue of shares at any given period of time is itself subject to rising marginal cost of borrowing (or the rate of prospective dividend), for beyond a certain limit more shares of a given firm can only be floated in a given

[1] The importance of retained income in financing the investment expenditures in modern business enterprises can be seen from the following witnesses given during the hearings before the Temporary National Economic Committee of the U.S. Senate. According to Dr. Oscar L. Altman of the Securities and Exchange Commission, for the period 1923–29 the average amount spent by business enterprises in the United States for plant construction, machinery and equipment (exclusive of increases in inventories) was 8·5 billion dollars per annum; the average annual amount of investible funds available to the same business enterprises from internal sources—i.e. retained net income plus depreciation and depletion allowances —was 6·4 billion dollars per annum or approximately 75 per cent of the gross investment expenditures. (*T.N.E.C. Hearings*, Part 9, pp. 3684 and 4041.) And according to the data compiled by A. B. Hersey of the Division of Research and Statistics, Board of Governors of the Federal Reserve System, for the three post depression years 1935–37, during which the net investment was positive, the total undistributed gross income in fifty-six industrial companies actually exceeded their total gross investment expenditures on durable equipment during the same period. (*T.N.E.C. Hearings*, Part 9, p. 4044.) Mrs. Ruth P. Mack in her book, *The Flow of Business Funds and Consumer Purchasing Power*, also points out that "by and large, the statistical sample, as well as interviews with corporate officials, suggests that the majority of purchases of equipment in the industrial companies that have been investigated have been financed by retained income." (*Op. cit.*, p. 263.)

[2] Cf. Kalecki, *op. cit.*, pp. 98–106 and 128–32.

period of time by widening the margin between the prospective rate of dividend on new shares and the market long-term rate of interest.

Thus the supply curve of capital to the individual firm is constantly shifted to the right during the upswing, and consequently we cannot regard the marginal cost of borrowing as a unique increasing function of the total capital of the firm for the whole period of the upswing phase of trade cycle. And it would also be impossible to say that any fall in real wages, or any rise of product price relatively to prime costs, will necessarily lead to a reduction in the period of turnover of the investment expenditure. For if the net investment expenditure stimulated by the fall of real wages does not exceed the distance by which the supply curve of credit in our first sense is shifted to the right, the firm need not come up against a higher marginal cost of borrowing (including subjective risk) than before, and consequently there is no inducement to resort to less capitalistic methods. Indeed the marginal cost of borrowing in the new situation may be lower than before, if the investment expenditure stimulated by the new decline in real wages falls short of the rightward shift of the supply curve of credit.

Strictly speaking, however, the marginal cost of borrowing to the individual firm is not exactly a function of the rate of its current net investment expenditures either, as Mr. Kaldor and Dr. Wilson assume it to be, though this way of representing it is perhaps much nearer to fact than to say that is is a function of the total invested capital of the firm.[1] To put it roughly, we might say that given the market rates of interest and the general credit situation, the marginal cost of borrowing including subjective risk to a firm is a function of the percentage excess of the current planned net investment expenditure over the additions to the firm's own capital through retained profits and new issue of shares in the preceding period. In other words, as Dr. Kalecki puts it, the marginal cost of borrowing cum risk to a firm is an increasing function of the ratio of its commitments or indebtedness to its own capital, given the market rate of interest and the general credit situation.[2] Since the addition to the firm's own capital is likely to proceed at an increasing rate during the upswing and the improving business activity may make the banks and other lenders more willing to lend, it is therefore unlikely that the firm will be confronted with a higher marginal cost of borrowing, unless the planned current investment expenditure is greater than in the preceding period. It is therefore difficult to say that the reduction in capital intensity or the period of turnover of the gross investment expenditure

[1] Cf. Hayek, "The Ricardo Effect," p. 139, footnote 1.

[2] Cf. Kalecki, *op. cit.*, pp. 128–32, and also his *Studies in Economic Dynamics*, pp. 61–2.

may offset the investment expenditure for widening purposes and cause the rate of investment expenditures to decline, unless other factors are brought into consideration: such as the possibilities that the monetary authority might put a strict restriction on credit expansion when the boom is considered to have gone too far; that the expectation of entrepreneurs with regard to the level of demand for, and the prices of, their products may become inelastic, so that their policy is merely to step up current output to meet the peak demand which they do not expect to last; and that they may come to regard the current prices of machinery as abnormally high and therefore think it inopportune to introduce permanent changes at the moment.

It should be clear from what we have said that the proportion of fixed capital to working capital (or direct labour), in the case where both are perfectly divisible and there is no surplus capacity in either, will not be altered unless the marginal cost of borrowing to the firm concerned or the relative prices of capital goods and labour changes. Thus, assuming that there is no change in the relative prices of capital goods to labour, whether a firm will shorten the period of turnover of its investment expenditures depends solely upon the question whether the new marginal efficiency of investment curves for the firm concerned after a change in the prices of its products relative to wage rates will intersect the respective new supply curves of investible funds at higher marginal costs of borrowing than before. We must now consider whether it is true that a fall in real wages will necessarily produce such effect.

We have so far used the expressions of real wages and the cost-price relationship indifferently as if they were identical terms. In doing this, we are only following the practice of both Professor Hayek and his critics. In fact, however, in so far as we are dealing with the individual firms, raw material cost, apart from direct labour cost, also constitutes a large part of the prime cost. We have already observed in our previous statistical inquiries that although there is a very vague negative association between real wages—i.e. product wages—with trend eliminated and the level of employment in manufacturing industries in the United States from 1919 up to 1930, this negative association appears to no small extent, to be the result of the variations of raw material prices relative to the money wages rates of labour, and that after 1930 the influence of the changes in raw material prices upon product wages is still quite noticeable, although the negative association between real wages and employment seems to have disappeared.[1] Now it is obvious that if the price of the product rises relatively to labour cost merely to offset the

[1] *Vide supra*, p. 67.

higher cost of raw materials incorporated in the product, the fall of real wages thus brought about need not increase the profitability of investment either in direct labour or in fixed capital and invoke the operation of the Ricardo Effect.

Professor Hayek, however, did not provide us with any solution for this complication. In his earlier essay, he treated raw material cost on a quite different footing from labour cost. It is maintained there that "a rise in the 'real' value of raw materials (i.e. their value in terms of consumers' goods) has exactly the opposite effect on investment to that of a rise in real wages."[1] The reason which he submitted for this paradoxical distinction is that "while labour, so far as provision for an expansion of output is concerned, is to a large extent a possible substitute for machinery, raw materials are required in practically fixed amounts per unit of output of any particular commodity. While, therefore, a rise in the price of either machinery or labour may increase the demand for the other of these two factors (and a fall in the price of one will decrease the demand for the other), a rise in the price of raw materials will not only decrease the demand for both labour and machinery, but will also discriminate against the latter because it will at the same time raise the cost of machinery."[2]

This line of argument for the discrimination between labour and raw material costs, however, is not very convincing. For the Ricardo Effect is supposed to operate without a primary change in the prices of machinery relative to money wages. It is not a matter of substituting labour for machinery because the latter has risen in prices relatively to wage rates. It operates, as Professor Hayek explains it, through a change in the relative marginal rates of profit on investments of shorter and longer periods of turnover. It is, therefore, hard to see why changes in raw material cost should be treated on a different footing from labour cost. This point can be realized more clearly, when we abandon the unrealistically simplified model of a perfectly integrated system, whose only current factor of production is labour, which it uses either directly or in a roundabout way in the production of the ultimate consumption goods, and come to analyse the more realistic firm in Professor Hayek's later article—viz. a firm, which, being confronted with a given supply condition of liquid funds, is balancing the advantages and disadvantages of investing them in working capital or in fixed capital of longer periods of turnover. Although in his later article Professor Hayek has attempted rather unduly to restrict the scope of his own theory by assuming that all the firms purchase no raw materials from outside and consequently that

[1] *Profits, Interest and Investment*, p. 29.
[2] *Ibid.*, pp. 29–30.

labour cost is the only form which circulating capital can assume;[1] in fact, however, raw materials in process generally form a very important part of the circulating (or working) capital of any firm in the modern world and the difference between current labour cost and raw material cost, as far as the period of turnover is concerned, is quite immaterial. In the case where labour and raw materials are both applied continuously during the process of fabrication and where both are paid for the moment when they are applied, the periods of turnover of the working capital invested in labour and that invested in raw materials must be the same and both equal to half the time required to manufacture the product of the firm within the firm concerned—i.e. half the period of production in the Anglo-Saxon sense. In reality, it is more usual that while labour is applied more or less continuously during the process of fabrication and is generally paid for weekly, raw materials are not only bought at bigger time intervals but a considerable stock of them, apart from those actually in the process of fabrication, is generally required for efficient operation. Thus the circulating capital embodied in raw materials will in reality have a longer period of turnover than that embodied in wage bills. However the difference cannot be very significant. What is more important is the fact that when a firm contemplates an immediate expansion of production because of, say, a rise in the price of product, additional expenditures on wages and raw materials must be incurred together and the elasticity of substitution between the two is negligible. We may therefore quite legitimately lump them together as additional working capital[2] regardless of the slight difference in periods of turnover.

When we realize that for individual firms, expenditures on raw materials for current production can be treated on the same footing with expenditures on wages, the apparent complications arising from changes in the prices of raw materials disappear. For a fall in the prices of raw materials relatively to the price of the product concerned has the same effect of raising what Professor Hayek terms "the proportional gain on each sale"[3] as a fall in money wages relatively to product price. Since in Professor Hayek's theory it is the variation of this "proportional gain on each sale" which is supposed to change the relative rates of profit on capitals invested for different periods of turnover,[4] it is obvious that the factor that is responsible for setting

[1] "The Ricardo Effect," p. 131.

[2] Following the distinction made by Lord Keynes between working capital and liquid capital, we understand by the former goods in process of manufacture within the firm concerned, including normal stocks of raw materials and finished products required for efficient business operation. Surplus stocks of raw materials held speculatively in expectation of a rise in their prices and involuntarily accumulated finished products are therefore not working capital in the strict sense.

[3] *Ibid.*, p. 132.

[4] *Ibid.*, pp. 132–3.

the Ricardo Effect into operation is not just the variation in the wage-price relationship or real wages, but rather the variation in the unit prime cost-price relationship—i.e. the gross profit margin as we have defined it in our previous chapters.

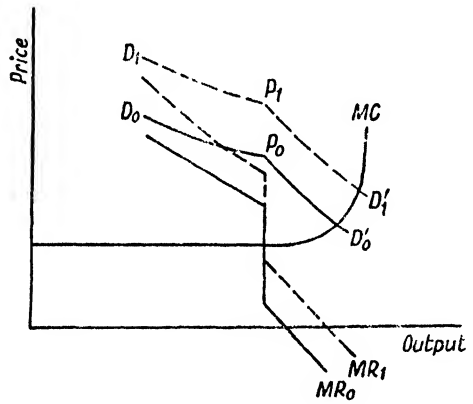
When we take the gross profit margin or the unit prime cost-price relationship, instead of real wages, as the independent variable, the difficulty arising from improvements in technology, which Professor Hayek points out but leaves unsolved,[1] seems to disappear also. For an increase in productivity of labour due to technical improvement, which lowers the labour cost per unit of output, will increase the percentage profit margin if not sufficiently offset by a reduction of price. And it seems to me that the increase in profit margin thus brought about should have the same effect on the "proportional gain on each sale," which in turn will alter the relative rates of profit on investment for different periods of turnover, as an increase in profit margin due to a rise in price with cost remaining the same will have. Thus it would appear that the gross profit margin, or the prime cost-price relationship, is a far more relevant concept to Professor Hayek's theory than real wages, which term seems rather to be an unfortunate misnomer.

There is one more important point, which we must clear up. It seems to me that the concepts of "the proportional gain on each sale" and "the internal rate of return" in Professor Hayek's theory are both average concepts and not marginal concepts.[2] But what in fact determines the investment activity of the entrepreneur of a firm is not the average rate of profit on the whole capital of a firm that is already invested (or the average rates of profit on different parts of the invested capital of the firm, if these can be calculated separately), but the marginal rates of profit on all different lines of fresh investment, which, if he is to maximize his aggregate net profit, he must endeavour to equate to his marginal cost of borrowing. There is no reason at all why the average rate of profit on capital of all kinds should be made equal to the marginal cost of borrowing, especially in the short period. Although it is true that an independent rise of the price of the product relatively to the prime cost will necessarily raise the average rate of profit on capital already invested, the marginal rates of profit on new investments either in working capital or in fixed capital may be affected quite differently and, in certain cases, may not be increased at all. For the wage-price relationship—i.e. real wages—in Professor Hayek's theory, or more exactly the prime cost-price relationship, is itself an average concept. It does not allow, on the one hand, for the possibility that marginal cost may be rising and differ from the average prime cost and, on the other hand, for

[1] *Ibid.*, p. 151. [2] *Ibid.*, p. 132.

the fact that under imperfect competition the marginal revenue from an increase in output under given demand conditions is always smaller than the price of product and is always diminishing.[1]

That a rise in the profit margin (or a fall in real wages if there are no changes in raw material prices) does not necessarily imply an increase in the marginal rates of profit either on working capital or fixed capital can be demonstrated by an example, though it is rather artificially devised. Suppose the demand for the product of an industry rises with the rise of general activity and the price-leader of the industry, with the tacit agreement of the rest, decides to raise the price in such a way that the quantity demanded of the industry—and, since the increase in price is followed by every firm, the quantity demand of each firm—happens to remain the same as before. Suppose also that wages and raw material prices remain constant. The new situation of a typical price-follower firm as compared with its previous situation can be depicted in the accompanying diagram. The profit margin is increased, and with it, the "internal rate of return" or the average rate of profit on the capital of the firm is also increased. But since, as we have observed above, the typical firm frequently has a kinked expected demand curve and its marginal revenue is consequently indeterminate over a wide range, a moderate vertical uplift of the demand curve is likely to leave the marginal revenue still equal to the marginal prime cost at the original



[1] Professor Hayek has indeed attempted in some places to impart a marginal meaning to his concept of real wages by saying that by real wages he really means "the relation between the costs of labour and the marginal product of that labour," thus taking into account the possible divergence between the marginal labour cost and money wage rate due to falling marginal productivity of labour. (*Ibid.*, p. 151.) But since, as we have observed in the previous chapters, marginal productivity of labour is usually more or less constant in manufacturing industries and the entrepreneurs generally take the average prime cost as an adequate approximation of marginal cost, falling marginal productivity of labour is probably not an important factor until the bottle-neck of plant capacity is reached. What is far more important is the falling marginal revenue, which Professor Hayek failed to take into consideration at all. On the other hand, Mr. Kaldor in his article "Capital Intensity and the Trade Cycle" has coined in one place the term "marginal real wages" to denote the ratio between the marginal revenue of output and the price of input. (*Loc. cit.*, pp. 49–50 and footnote p. 50.) But surely this is stretching the original meaning of the word too far and will only lead to confusion.

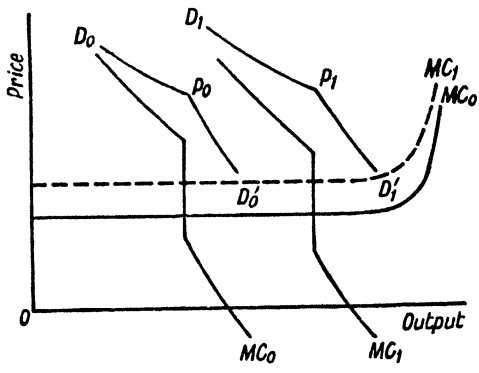
margin of production.[1] In other words, the marginal rate of profit on working capital is still equal to the interest (cum risk) charge on the additional working capital for its period of turnover. Thus although the profit margin has been considerably increased by the rise of price, marginal rate of profit on working capital is left substantially undisturbed, and there is no incentive to expend more liquid funds on additional working capital.

If the rise in product price relative to prime cost under such circumstances does not increase the marginal rate of profit on working capital, will the increase in profit margin have any effect upon the marginal rates of profit on investments of longer periods of turnover? Would the Ricardo Effect operate in this case through depressing the marginal rates of profit on investments of longer periods, such as machinery? The answer is obviously negative. For if the firm has no incentive to expand its output, the marginal rate of profit on investment on machinery consists of the saving in labour cost (minus depreciation allowances) per unit of time through expending an additional sum of liquid fund on machinery divided by this sum. Given the money wage rates, the prices of machinery, and the technical labour-saving capacity of machine equipment, the marginal productivity of machinery and the marginal rate of profit on investment on machinery must therefore remain the same as before. Furthermore, there is no reason to expect the marginal cost of investible fund to the firm concerned to rise, as there is no competition for liquid fund from the side of working capital. In fact, the increased gross profit of the firm will put a bigger internal supply of liquid funds at its disposal, and thus shift its individual supply curve of credit farther to the right. Therefore, an increase in profit margin, or a fall in real wages, may give the firm concerned no incentive either to expand its output—i.e. to increase its working capital—or to reduce its capital intensity.

On the other hand an increase in the marginal rates of profit on investments of all periods of turnover might occur with a rise in real wages, or more exactly a fall in profit margin. Again an example will make this clear. Suppose there is an expansion of the demand for the products of an industry due to the upswing of the general activity, and suppose that the prevailing price policy in that industry is one of price stabilization—i.e. rigid price policy—so that, with a simultaneous rise in money wage rates and raw material prices, the profit margin is narrowed and real wages increased. The situation of a typical firm in that industry may be shown in the accompanying diagram. Although prime cost has risen relatively to price—which is kept constant all the time—nevertheless, the marginal revenue at

[1] *Vide supra*, p. 70.

the original margin or production has considerably risen relatively to marginal prime cost. Thus the firm will be eager to expand production. The marginal rates of profit on investments of all kinds, that may contribute to the expansion of output, will be increased as compared with the respective rates before the change. And, as Professor Hayek's previous example[1] has shown, the marginal time rates of profit on investments of different periods of turnover will be increased relatively more or less in the reverse order of the lengths of their periods of turnover; the marginal rate of profit on investment of the shortest period of turnover—i.e. on additional working capital—will be increased most of all. Consequently the demand for additional working capital will take precedence over the demand for additional capital of longer periods of turnover in the claim on the available supply of liquid funds. If the expected demand curve for the product of the firm has been shifted so far to the right that the firm will prepare for a large expansion of output, the total investment demand stimulated by the increase in demand may strain the available sources of liquid funds of the firm so much that it will be confronted with a higher marginal cost of borrowing, or more stringent conditions of borrowing than previously. In such cases, the average period of turnover of the firm's investment expenditures will be reduced, in spite of the fact that profit margin has decreased and real wages have risen.



Thus the true nature of the mechanism of the Ricardo Effect has gradually emerged clearly. It operates through the competition for the available supply of liquid funds of the firm concerned between the demand for additional working capital and the demand for investments of longer periods of turnover. The demand for additional working capital, if circumstances give rise to such demand, will generally have priority over the latter. Empirical observation of the practices of business finance appears to confirm this broad generalization. For instance, Mrs. Ruth P. Mack in her recent study on *The Flow of Business Funds and Consumer Purchasing Power* observes, after an examination of the statistics of a large number of firms in different industries and interviews with corporate officials, that "since the need for working capital typically takes precedence over the need for equipment

[1] *Vide supra*, pp. 120–1, and "The Ricardo Effect," pp. 133–4.

purchase, the question of whether or not there is money available for plant additions depends on whether there is more than is needed for current operations."[1] Obviously, if the supply of investible funds to the firm concerned is perfectly elastic, such competition is ineffective. Both the demand for additional working capital and the demand for plant additions can then be satisfied fully until the marginal rates of return on both forms of investment are equal to the constant rate of interest. The competition for funds becomes operative only when the supply of investible funds is scarce relative to the investment demand for funds and is subject to rising cost of borrowing. When the demand for investible funds stimulated by an expansion of demand—including therefore the demand for additional working capital—is big enough to strain the supply of liquid funds and to drive up the marginal cost of credit, then the demand for additional working capital is likely to take the lion's share and the proportion of the available liquid funds applied to investments of longer periods of turnover will be reduced.

Now it is obvious from what we have observed above that the demand for additional working capital of a given firm, which depends mainly upon the extent to which the firm wishes to expand its current output, is not uniquely determined either by the wage-price relationship—i.e. real wages—or by the prime cost-price relationship—i.e. the profit margin. We cannot even say that it is uniquely determined by the gap by marginal revenue and marginal cost at the original level of output (a concept which does lend itself to statistical estimation and which is consequently useless for statistical investigation); for the extent to which current output will be expanded depends also upon the slopes of the expected new marginal revenue curve and the marginal cost curve. With general presumption of a kinked demand curve, it seems to be more reasonable to say that the demand for additional working capital depends upon the extent to which the expected individual demand curve is shifted to the right—i.e. upon the firm's expectation as to how much more can be sold at the prevailing market price.

Therefore, there seems to be no particular *a priori* reason for expecting that a decline in real wages, or, more exactly, an increase in the profit margin, will be associated with a reduction in the average period of turnover of the investment expenditures. In other words, we cannot relate the operation of the so-called "Ricardo Effect" directly to changes in real wages or profit margins. All we can say is that when current output is planned to be increased very rapidly, the great requirements for investible funds to build up additional working capital may cause the entrepreneurs to reduce the proportion

[1] *Op. cit.*, p. 263.

of investment expenditures of longer periods of turnover. And progressive reduction of the period of turnover of the investment expenditures can only occur when current output is planned to increase at an increasing rate. Thus it is theoretically more significant to observe with the aid of statistics whether there is in fact any tendency for the period of turnover of investment to become shorter when current output is expanding rapidly than to observe whether there is any connection between real wages or profit margins and the period of turnover of investment.

We must, however, remind ourselves that so far the discussion on the Ricardo Effect is based on the following tacit assumptions: (1) that capital equipment is always utilized up to its normal capacity; (2) that there are no technical innovations in machines or in the technical knowledge with regard to the method of production; (3) that capital equipment is perfectly divisible; (4) that the elasticity of expectation with regard to the demand for the products, prices and costs is equal to unity; (5) that there is no change in the relative prices of capital goods and labour; and (6) that the market rates of interest remain constant. When any of these assumptions is not satisfied, the above conclusion will have to be further modified.

Consider, for instance, the consequences when the first assumption is not fulfilled. If there exists a large amount of un-utilized excess capacity in existing capital equipment, as is generally the case at the bottom of a slump, then investment expenditures will chiefly consist of working capital when effective demand recovers, even if the profit margin is small and current output is expanding only slowly. When the upswing has been under way for some time and the degree of utilization of the existing capital equipment is approaching full capacity, investments in fixed capital will have to be undertaken, if the effective demand is still rising, and the period of turnover of investment expenditures may increase as compared with the earlier stage of the upswing.

Secondly, if investments in fixed capital are undertaken, as they in fact often are, because the advances in technology make the existing machinery obsolete, again our generalization about the Ricardo Effect must be qualified. For it is difficult to generalize about the rate of technical progress and the cost-saving capacity of the improved machines. Furthermore, when new types of machinery, or other cost-saving arrangements or devices, are more or less indivisible, then the savings in costs due to the introduction of the new equipment are the larger, the larger are the current and anticipated output. It appears that the accounting practices employed by many firms in modern industries to estimate the savings in costs that can be brought about by the introduction of new equipment are frequently based on the

tacit assumption of indivisibility. Mrs. Ruth P. Mack, in her inquiry about the purchase of industrial equipment, observes—

"When the unit costs on the new and old machines had been estimated, the unit saving had to be multiplied by the number of units that would be produced in order to be in a position to judge the return on the capital investment. Usually, 'normal volume' was used as the basis of the computation, at least by the engineers or superintendents who might make the original recommendation. But when this was done, consideration of the recommendation in the light of current volume nevertheless occurred at some stage of the pilgrimage of the equipment order. Moreover, even on the production floors, there seemed to be a tacit understanding that when volume was low there was no use making recommendations since they only 'came back'; . . . But as has been suggested, whatever the ostensible basis, current or immediately anticipated volume seemed to be the real basis of most of the calculations."[1]

Similarly, Messrs. D. V. Brown and E. M. Martin and their collaborators, in their investigation of the process of technological changes in the International Harvester Company, also maintain that the cost-savings of the new equipment are calculated by multiplying the reduction of labour and material costs per unit of the product or part concerned by a production figure for the product or part in question. The production figure is said to be sometimes that of last season and sometimes the expected production of the current season.[2] When this is the case, it is obvious that the volume of savings in costs due to a given new equipment is the larger, the larger is the expected current output. Or in other words, the expected rate of return on the capital invested in the new equipment is the higher, the higher is the level of current output. Thus, during the upswing, the enlarging effect of the increasing level of output upon the rate of return on investment in the indivisible cost-saving equipment may completely offset the possible influence in driving up the marginal cost of credit of the competition for investible funds from the side of the demand for additional working capital—i.e. the Ricardo Effect. Essentially the same argument applies to changes in designs of products that may involve capital expenses.

If the fourth assumption is not satisfied—i.e. if the entrepreneurs do not always expect that the present state of affairs will stay as it is for a long period to come but expect it to move on in either the same or the reverse direction—then again another set of forces will be operating upon both the rate of investment expenditures and their

[1] *Op. cit.*, pp. 256–7.

[2] T.N.E.C. Monograph No. 5, *Industrial Wage Rates, Labour Costs, and Price Policies*, edited by Douglass V. Brown and Edwin M. Martin, pp. 134–5.

periods of turnover. For if, as is generally the case in the early stage of recovery, entrepreneurs regard the current rise in demands and prices as a prelude to further rises in the future—i.e. the elasticity of their expectations is greater than unity—obviously a stimulus is given to provision for the expected increase in output in the future. In other words, it would stimulate the entrepreneurs to increase their investments of comparatively longer periods of turnover. On the other hand, when the upswing has been going on for some time and the current levels of effective demands and prices begin to exceed business men's concept of normal ranges of demands and prices, derived from their past experience in business fluctuations, they may come to expect that such boom level of effective demands and prices will not last for long, but will soon be reversed—that is to say, their elasticity of expectations with regard to demand and prices may become not only less than unity but even negative. In such a situation, they will undoubtedly refrain from making permanent additions to their plant capacity, and making hay while the sun shines will be the dominant policy. Thus not only the average period of turnover of investment expenditures will be reduced, but the rate of total investment expenditures may also be diminished. There is no doubt that a general inelasticity of expectations with regard to sales and prices throughout the industry at a late stage of a flourishing boom can be a very potent force in bringing the boom to an end and turning it into a recession.

That a fall in the prices of capital equipment relatively to the prices of labour will induce the entrepreneurs to substitute capital goods for labour, and conversely, is obvious enough. In a world of perfect competition, where diminishing returns to labour must be the rule, the prices of capital goods must rise relatively to wages during the upswing when the output of capital goods is increasing, just as the prices of any other manufactured commodities must rise relatively to wages. But for reasons explained in our previous chapters, this is not necessarily the case in a world where competition is predominantly imperfect.[1] Whether the prices of capital goods tend to rise relatively to money wages in general or not can only be ascertained from facts. We shall therefore attempt to find out statistically what the actual movement of the price ratio between investment goods and labour has been in the past. In the following table, the index of the prices of investment goods and the index of hourly money wage rates in the United States for the period 1919–35 are compared and the ratio between them is computed. We can see that there was a declining trend in the wage-unit prices of capital goods which was very strong at the beginning of the period but which gradually tapered off

[1] *Vide supra*, Chapters I and II.

towards the middle of the period. The falling of the prices of capital goods relatively to money wages must have been a stimulus to the introduction of capital equipment in place of labour. However, contrary to the prevailing views, there was little cyclical variations in this ratio apart from the trend. It is true that the ratio of the prices of capital goods to money wages was a little higher in 1929

PRICES OF INVESTMENT GOODS AND HOURLY MONEY WAGE RATES IN U.S.A. (1929 = 100)

	I Prices of Investment Goods[1]	II Money Wages[2]	III Ratio (I ÷ 2)
1919	110	76·5	143·8
1920	125	94·1	132·8
1921	105	87·7	119·7
1922	94	83·3	112·8
1923	101	90·6	111·5
1924	101	93·5	108·0
1925	98	95·2	102·9
1926	98	97·6	100·4
1927	96	98·7	97·3
1928	97	99·9	97·1
1929	100	100·0	100·0
1930	97	99·5	97·5
1931	94	92·4	101·7
1932	82	79·9	102·6
1933	78	77·2	101·0
1934	85	89·3	95·2
1935	86	93·2	92·3

than in the preceding year, but it was even higher in the three depression years of 1931–33 and declined when recovery was under way in 1934–35. At any rate, variations in this ratio apart from the trend are in general small. We may therefore regard the influence upon investment of the cyclical variations in the relative prices of capital goods and labour as rather insignificant.

In our discussion on the Ricardo Effect, we have so far neglected the changes in the rates of interest ruling on the market. In fact, however, the rates of interest generally tend to rise with the level of activity, particularly the short-term rate of interest. What complications will this fact introduce into our theoretical scheme? It is the

[1] The index of prices of investment goods is obtained from Dr. Kalecki's *Essays in the Theory of Economic Fluctuations*, p. 39, Table 3. It is a weighted average of the building costs and the prices of movable equipment.

[2] See Statistical Appendix to Chap. III, Table III, *infra*, pp. 157–8.

traditional view that a rise in the market rate of interest will tend to induce the entrepreneurs to employ less capital in proportion to labour. Recent empirical inquiries in the form of questionnaires and interviews, however, invariably lead to the conclusion that in the majority of cases, changes in the rates of interest have very little influence on the investment decisions of business men.[1] This conclusion is obviously in contradiction with the traditional theory of capital. How is this to be explained? It seems to me that the solution of this apparent contradiction lies in the fact that the traditional proposition is implicitly based upon the rather unrealistic assumption that the market for loans is perfect and the market rate of interest is always identical with the actual marginal cost of credit to the individual firms. We have already seen above that his assumption is quite untrue in the real world.[2] In general, every individual firm, at any given moment of time, is confronted with a rising supply curve of credit, and the marginal cost of credit (inclusive of subjective risk and other terms of borrowing) to an individual firm is necessarily rising with the increase in its total amount of "commitments" in relation to its own capital and may eventually rise steeply into a "vertical wall" when the firm approaches the practical limit of its borrowing facilities. Therefore, the actual marginal cost of credit to the firm is generally much higher than the market rate of interest, and it must be the actual marginal cost of credit, not the market rate of interest, that determines the optimal capital intensity of the firm. As far as my knowledge goes, it is Dr. Kalecki who first demonstrated that with constant returns and perfect competition, a rise, or a fall, in the market rate of interest will not affect the method of production employed, but will merely decrease, or increase, the amount of investment expenditure.[3] For with perfect competition and constant returns to scale, the marginal rate of profit on investment, which is determined by the relation between costs and prices, is necessarily constant irrespective of the amount invested, or the marginal efficiency of investment curve is always horizontal. Since the entrepreneur will invest that amount, the marginal cost of borrowing of which is equal to the marginal rate of profit, therefore, a rise in the market rate of interest, which shifts the marginal cost of credit curve bodily upward, will nevertheless not alter the effective marginal cost of credit, which is still equated to the constant marginal rate of profit. This situation

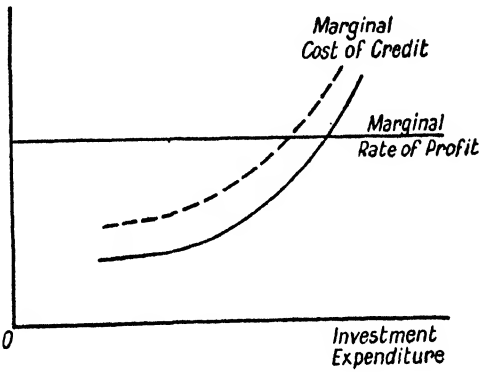
[1] See: J. E. Meade and P. W. S. Andrews, "Summary of Replies to Questions on Effects of Interest Rates," *Oxford Economic Papers*, No. 1, October, 1938, and P. W. S. Andrews, "A Further Inquiry into the Effects of Rates of Interest," *Oxford Economic Papers*, No. 3, February, 1940, and also J. Franklin Ebersole, "The Influence of Interest Rates upon Entrepreneurial Decisions in Business—A Case Study," *Harvard Business Review*, Autumn, 1938.

[2] *Vide supra*, pp. 126–7.

[3] Kalecki, *op. cit.*, pp. 102–5.

is illustrated in the accompanying diagram. The only effect of a rise in the market rate of interest is that the amount of investment expenditure will be smaller than it otherwise would be. In such a case, it is the marginal rate of profit that will play the role, which in traditional theory the rate of interest is supposed to play.

However, the empirical inquiries suggest that to a majority of firms, changes in the market rates of interest not only do not affect their choice of method of production but also do not influence their decision as to the amount to be invested. For instance, Mrs. Mack reports that "in almost every office which I entered I asked whether the rate that had to be paid for money was an important factor in the decision to purchase equipment. The answer was universally in effect that it was not really a question of what you had to pay for it but of whether or not you could get it."[1] Mr. Kalecki's explanation certainly does not account for this fact. Furthermore his assumption of a horizontal marginal rate of profit curve is rather unrealistic in a world of imperfect competition. For with imperfect competition, the marginal efficiency of investment curve will generally be falling because of the falling demand curve for the products of the firm.[2] If the marginal efficiency of investment curve is downward sloping, an upward shift of the supply curve of credit will force up the marginal rate of profit and the effective marginal cost of credit to the firm and may consequently affect the capital intensity of the investment expenditure. How then are we to account for the indifference to changes in the rate of interest?

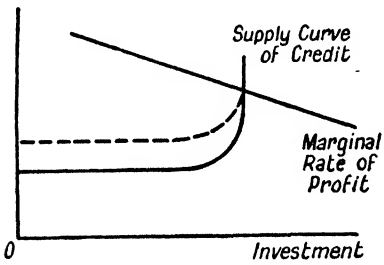


As we have already noted above, modern firms generally finance

[1] *Op. cit.*, pp. 265–66.

[2] Dr. Kalecki appears to think that even under imperfect competition the marginal efficiency curve of investment to individual firms may be horizontal, on the ground that the effect of imperfect competition in limiting the amount of investment may be overcome by spreading the latter over various fields of industries. (*Op. cit.*, p. 98.) But surely it is rather unrealistic to assume that each firm—i.e. each financial unit of control—operates productive plants in a large number of different lines of industries so that it can spread its investment in such a way that the falling marginal revenue in each line of industry is not felt. And with the large technical optimum scale of production in almost every line of industry under modern conditions of production, it is not easy for a firm to enter into a new line of production entirely different from those in which it is already engaged.

a great part of their investment expenditures out of their own resources.[1] Therefore a great stretch of the supply curve of credit of a firm is practically horizontal, as the opportunity cost of applying its own liquid resources on investment in its own business is the rate of interest which it can obtain by investing them on a more or less temporary basis outside. When its demand for investible funds exceeds its own liquid resources, the marginal cost of borrowing rises rapidly until the curve becomes almost vertical. When the investment demand for funds is straining against such almost vertical section of the supply curve, as is likely to happen during a period of rapid expansion, the question of what you have to pay for loanable funds is entirely overshadowed by the question whether or not you can get it, as suggested by Mrs. Mack's inquiry. If such is the situation faced by most firms during the upswing, then a considerable upward shift of the supply curve of credit due to the increase in the market rates of interest may have little effect on the actual cost of borrowing at the margin and consequently have little influence on the investment decisions. Therefore the influence upon the capital intensity of investment of the rises in the rates of interest during the boom may not be very important.[2]



There is one further important complication which we must bear in mind in examining the variations of the period of turnover of investment expenditures during the trade cycles. That is, in fact, a great part of the investment in durable equipment appears to be a function of the level of effective demand and output rather than a function of the increment in demand and output, as can be seen from the available statistics.[3] If the acceleration principle in the strict mechanistic sense operates at all, it perhaps applies only to working capital and a small portion, if any, of the investments in fixed capital. Under such situation, an increase in the rate of expansion of current output will automatically lead to an increase in the ratio of investment on additional working capital to investment on durable equipment simply because the bulk of the demand for the latter kind of investment is more or less insensitive to the short-period rate of increase of current output. Such changes in the proportion between investment expenditures on working capital and on fixed capital can happen

[1] *Vide supra*, p. 128, footnote 1.
[2] Cf. Hayek, *Profits, Interest and Investment*, pp. 66–7.
[3] See also J. Tinbergen, "Critical Remarks about some Business Cycle Theories," *Econometrica*, April, 1942.

quite independently of any changes in the so-called "multiplier of the acceleration principle" or of the operation of the "Ricardo Effect," which, we have seen, is merely the competition for the more or less limited supply of investible funds from the side of the demand for additional working capital.

Thus we have observed that the average period of turnover of investment expenditures during the upswing is subject to many influences apart from the operation of the Ricardo Effect. It would still be an almost impossible job to single out the influence of the Ricardo Effect alone, even if the exact measurement of the period of turnover of investment expenditures presented no difficulties. The measurement of the period of turnover of investment expenditures, however, is itself a very ticklish task. Professor Hayek himself has suggested the concept of the "Quotient" as a sort of measurement for the capital intensity of investment expenditures.[1] By the "Quotient" he means the ratio of the ultimate contribution to the flow of final consumers' goods after due time-lag to the amount of investment expenditures to which it is due. Apart from the theoretical defects which Professor Hayek himself has pointed out,[2] it is, however, extremely difficult to put this concept to statistical measurement. For, first of all, the time-lag between a dose of investment expenditure in the early stage of production and its ultimate contribution to the flow of final consumable goods and services may be a very long one and quite unascertainable. Furthermore, its ultimate contribution to the flow of consumers' goods will depend very much upon the future application of various inputs in the later stages of production, which in a dynamic world is highly uncertain and fluctuating, depending very much on the state of effective demand in future dates which the entrepreneur may not be able to forecast when he decides upon the initial investment expenditure. At any rate, whatever may be the justification from the point of view of pure theory of capital, for our present purpose it is necessary to compare the investment expenditure with its ultimate contribution to the flow of consumers' goods. For our purpose is to see whether there is a tendency for the individual firms to vary the period of turnover of their investment expenditures during the upswing. And for these individual firms, their capital is turned over when the initial expenditure is retrieved out of the sales proceeds of their products whether they be consumers' goods or producers' goods.

A rough-and-ready index of the average period of turnover of investment expenditures, however, can be obtained from the ratio of total investment in business inventories—i.e. total net addition to

[1] *Ibid.*, pp. 49–50.
[2] *Ibid.*, p. 50, footnote 1.

working capital and stocks of commodities—to the net total investment for business purposes (including both investments in inventories and in durable equipments). It indicates the proportion of the investment expenditures directed to shorter sorts of investment as compared with investments of a more durable nature and thus may provide some rough indication of the average period of turnover. In the following table, we shall compare the ratio of net capital formation for business

THE VARIATIONS OF THE RATIO OF NET CAPITAL FORMATION FOR BUSINESS PURPOSES TO CHANGES IN BUSINESS INVENTORIES IN THE U.S.A.

Year	I Net Capital Formation[1] (at Current Prices) (in million dollars)	II Change in Inventories[2] (at Current Prices) (in million dollars)	III Ratio I over II	IV Production of new Commodities[3] (at Current Prices) (in billion dollars)	V Product Wage Rates in Industry as a Whole[4] (Trend Removed)	VI Product Wage Rates in Manufacturing Industries[5] (Trend Removed)	VII Profit Margin in Manufacturing Industries[6] (percentage)
1919	6,831	4,132	1·65	61·4	83·2	81·0	22·4
1920	9,418	7,375	1·28	69·1	87·2	85·0	—
1921	674	54	12·48	49·5	121·4	108·3	21·9
1922	1,872	534	3·51	51·2	108·0	105·9	—
1923	5,581	3,016	1·83	60·6	105·2	106·9	23·2
1924	1,701	−917	—	58·0	104·8	110·7	—
1925	5,183	1,788	2·90	65·4	96·0	102·3	24·2
1926	5,118	1,586	3·23	67·8	98·9	99·4	—
1927	3,945	464	8·50	66·1	100·3	102·1	25·3
1928	3,242	−321	—	66·9	96·7	100·2	—
1929	6,769	2,414	2·80	71·6	95·9	99·4	26·7
1930	1,406	−1,128	—	58·5	102·6	102·4	—

purposes to changes in business inventories (both in current prices) with the total production of new commodities (also in current prices), product wage rates in industry as a whole, and average profit margin in manufacturing industries as in the United States. The ratio of net capital formation for business purposes to changes in business inventories is computed from the figures calculated by Dr. Simon Kuznets in his book *Commodity Flow and Capital Formation*. Dr. Kuznets' figures of net capital formation and changes in business inventories are available from 1919 to 1935. However, for the years 1924, 1928, 1930, and 1935, net capital formation for business purposes and net changes in business inventories are of different signs. Consequently the ratio between them is rather devoid of meaning. For the years 1931–34

[1] Reproduced from Simon Kuznets, *Commodity Flow and Capital Formation*, Table VIII–3, p. 494.

[2] *Ibid.*, Table VIII–2, p. 484.

[3] *Ibid.*, Table VIII–1, p. 479. The production of new commodities is the sum of the total flow of finished commodities + net changes in inventories, finished or unfinished + volume of total construction + net changes in miscellaneous inventories + balance of trade commodities.

[4] *Vide infra*, Statistical Appendix to Chap. III, Table III, pp. 157–8.

[5] Ditto, Table IV, p. 159.

[6] *Vide supra*, p. 73.

inclusive, both the net investment in durable equipment and changes in inventories are negative. Although the ratio between net total investment and changes in inventories under such circumstances would be a positive figure, such ratio would have a quite different significance from what it implies when both are positive. Since our main interest is to observe the behaviour of the capital intensity during the upper swing, we shall omit these depression years.

It can be observed that the ratio of net investment to changes in inventories does seem on the whole to vary inversely with the total value of current output (or the level of money income). In other words, the proportion of investment in inventories to total net investment (and therefore to net investment in durable equipment) tends to increase when the level of money income is high and to fall when money income is low, with the exception of 1926 and 1928. The year of 1924 is no exception, for the proportion of investment in inventories in that year not only decreased but became negative, so that the total net investment consisted entirely of investment in durable equipment. There also appears to be some positive association between the ratio and the rate of product wages in industry as a whole. That is to say, the proportion of net investment in durable equipment in the total net investment tends to rise, when product wages rise, and to fall when product wages fall. The year 1920 is obviously an exception. The years 1924 and 1928 also do not seem to conform to the general tendency, for in both years investment in inventories became negative and net investment consisted entirely of investments in durable equipment, although product wages had fallen. Moreover, this ratio also stood higher in 1925 than in 1923, though product wages were considerably lower in 1925. At any rate, since we have observed above in our theoretical discussion that there is no necessary theoretical connection between changes in product wages and in average period of turnover of investment expenditures,[1] we are not warranted in jumping to the conclusion that this vague positive association is the result of some causal relationship between the two. This sceptical attitude is justified, when we observe that the ratio of net investment to changes in inventories shows no definite correlation with either the product wage rates in manufacturing industries in terms of finished manufactured goods or with the profit margins in manufacturing industries, although Professor Hayek has stated that for the operation of the Ricardo Effect, it is the wage-price relationship, or more exactly the cost-price relationship, in manufacturing industries that is of importance.[2] As can be seen from the table, the ratio of net investment to changes in inventories is almost as likely to rise as to

[1] *Vide supra*, pp. 130–7.
[2] See "Ricardo Effect," p. 151.

fall when product wages in manufacturing industries fall, and conversely when the latter rise. As to the relation between capital intensity of investment and profit margins, we can see that although the former (as indicated by the above index) rose considerably when the latter declined in 1921 and fell again when the latter recoved in 1923, the former continued to rise from 1925 until 1929, while profit margins were also rising. Thus these figures do not seem to vindicate Professor Hayek's theory.

There is, however, a serious defect that mars the aptness of the ratio of net investment to the increase in inventories as an index of capital intensity of the investment expenditures. That is, while we are interested in the planned period of turnover of the *ex ante* investments, this ratio indicates rather the capital intensity of the *ex post* investments. For the changes in business inventories include not only the planned additions to working capital in the strict sense, but also the involuntary accretion or decrement of stocks when the effective demand turns out to be different from what was expected. Thus it might be objected that the increase in the proportion of net investment in inventories at the upper turning-points—e.g. 1921, 1923, and 1929—might have been simply the result of the involuntary accumulation of unsold stocks of commodities, rather than due to entrepreneurs' deliberate policy concerning their investments. There seems to be no way of separating the involuntary accretion or decrement of stocks from the designed investment or disinvestment in working capital. But the difficulty can be somewhat circumvented in the following way. We know that investment in working capital in the strict sense is closely related to changes in the volume of current output, and we know also that investment in durable equipment is generally the result of deliberate planning and provides little scope for involuntary accretion or decrement. Therefore, by comparing net investment in durable equipment alone with the value of the increment of current production (as distinguished from the increment in the money value of current production), we may obtain some idea as to how the entrepreneurs have decided to divide their investment expenditures between provisions for the immediate expansion of current output and investments of more durable nature.

In the following table, we compare the net investment in durable equipment with the value of the increment of the current production of new commodities in the United States and with various other relevant series.

It can be seen at a glance that the acceleration principle in the narrow and mechanistic sense cannot have been an important factor in determining the net investment in durable equipment. In many years during which the physical volume of current output was

declining, net investment in durable equipment remained positive and at a fairly high level. It certainly appears to be more closely correlated with the level of current production of new commodities rather than with its rate of changes.

As regards the capital intensity of the investment expenditures, the comparison of net investment in durable equipment and the increment of current production shows somewhat different results for certain years from the ratio of total net investment to changes in

NET INVESTMENT IN DURABLE PRODUCERS' GOODS AND THE INCREASE IN THE CURRENT PRODUCTION OF NEW COMMODITIES IN THE U.S.A.

Year	I Production of New Commodities (at Current Prices) (in billion dollars)	II Increment in Production of New Commodities[1] (at Current Prices) (in million dollars)	III Net Investment in Durable Equipment (at Current Prices)[2] (in million dollars)	IV Ratio III over II (when both positive)	V Product Wage Rates in Industry as a Whole (Trend Removed)	VI Product Wage Rates in Manufacturing Industries (Trend Removed)	VII Profit Margin in Manufacturing Industries (percentage)
1919	61·4	—	2,699	—	83·2	81·0	22·4
1920	69·1	− 16	2,043	—	87·2	85·0	—
1921	49·5	− 4,006	620	—	121·4	108·3	21·9
1922	51·2	5,627	1,338	0·24	108·0	105·9	—
1923	60·6	7,774	2,565	0·33	105·2	106·9	23·2
1924	58·0	− 1,496	2,618	—	104·8	110·7	—
1925	65·4	7,069	3,395	0.48	96·0	102·3	24·2
1926	67·8	2,015	3,532	1·75	98·9	99·4	—
1927	66·1	1,438	3,481	2·42	100·3	102·1	25·3
1928	66·9	− 475	3,563	—	96·7	100·2	—
1929	71·6	4,473	4,355	0·97	95·9	99·4	26·7
1930	58·5	− 9,968	2,534	—	102·6	102·4	—

inventories as given in the previous table. For instance, in 1920, when current output of commodities declined a little, net investment in durable equipment remained at a fairly high level, which fact must imply that there was a considerable increase in the capital intensity of the *ex ante* investment expenditures. The decrease of the ratio of net investment to change in inventories for the same year as shown in the preceding table must then be due to the involuntary accretion of unsold stocks of products, as the recession set in already

[1] The value of the increment of production of new commodities at current prices is computed by subtracting from the production of new commodities for each year at 1929 prices (S. Kuznets, *Commodity Flow and Capital Formation*, Table VIII-1, p. 480) the similar figure for the preceding year, and then converting these increments, positive or negative, into current values by means of a price index obtained by dividing the value of production of new commodities at current prices by their value at 1929 prices (*ibid.*, Table VIII-1 pp. 479–80).

[2] The amount of net investment in durable producers' equipment is computed by subtracting from the net total capital formation for business uses at current prices (*ibid.*, Table VIII-3, pp. 494–5) the total changes in business inventories (*ibid.*, Table VIII-2, pp. 484–5).

in February of 1920. At the next peak of activity in 1923, the period of turnover of *ex ante* investment expenditure again does not seem to have declined, as the ratio of net investment in durable equipment to increment in current output had increased as compared with the preceding year. The decrease in the ratio of net investment to increase in inventories in 1923 as shown in the preceding table must again be the result of involuntary accretion of unsold stocks during the latter half of the year, after the recession had started in June. During the years of increasing physical output—viz. 1925–27—the ratio of net investment in durable equipment to increase in current output is seen to be increasing. In the great turning point of 1929, the ratio has indeed declined as compared with 1927 and 1926, but it still stands higher than 1925, 1923, and 1922.

When comparison is made with product wage rates, there are indeed periods—viz. 1919–21, 1924–27, and 1928–29—during which product wages in industry as a whole and capital intensity of investments, as indicated by the relation between the net investment on durable equipment and the increment (or decrement) of current output, appear to move in the same direction. But there are also periods—viz. 1922–24 and 1927–28—during which they appear to move in opposite directions. The correlation between capital intensity of investment expenditures and product wages in manufacturing industries shown by this table is indeed greater than that indicated by the previous one. Only in the periods 1925–26 and 1927–28 did capital intensity of investment and product wages in manufacturing industries move in the opposite directions. In spite of all this apparent positive correlation, however, our previous theoretical discussion of this problem[1] should be a sufficient warning against rash induction of a direct causal relation between product wages and capital intensity of investment expenditures. This warning is all the more vindicated by the fact that no definite correlation can be detected between the percentage profit margins in manufacturing industries and the capital intensity of investment expenditures. On the one hand, the capital intensity of investment rose in the depression of 1921, when profit margins slightly declined, and relapsed to a lower level when profit margins rose again up to 1923. And capital intensity of investment expenditures in 1929 was also lower than in 1927, in which latter year profit margins were lower than in the former year. On the other hand, however, capital intensity of investments was higher in 1927 than in 1925 or 1923, although in these two latter years profit margins were lower than in 1927. Thus our figures give no evidence for the proposition that a rise in profit margin or a fall in product wages tends to reduce the period of turnover of investment expenditures,

[1] *Vide supra*, pp. 130–7.

which proposition we have already shown theoretically to be *non sequitur*.

What appears to be the chief factor determining the capital intensity of investment expenditures is the rate of increase of current output. It can be easily observed from our table that during the upswing an increase in the increment of current output generally leads to a decrease in the ratio of net investment in durable equipment to the increase in current output, and that a decrease in the increment of current output, or an absolute decrease, generally leads to an increase in the capital intensity of investment expenditures. The year 1923 appears to be the only exception. This seems to accord well with our theoretical argument that the true mechanism of the Ricardo Effect is the competition for available investible funds from the side of the demand for additional working capital, and that therefore, if it operates at all, the decline in the period of turnover of investment expenditures will only occur when the rate of expansion of current output increases. And an increase in the rate of expansion of current output, however, as we have pointed out above, need not imply a fall in product wage rates or even an increase in profit margins, when imperfect competition is prevalent in industries.[1]

But we have also noted that the net investment in durable equipment appears to depend largely on the level of output rather than on the rate of increase of output. Thus with investments on durable equipment more or less insensitive to changes in the rate of expansion of current output, an increase in the increment of current output, which will necessitate a more or less proportionate increase in working capital in the strict sense, will automatically lead to a reduction of the capital intensity of the investment expenditures and vice versa.[2] Therefore, it is difficult to say how far the tendency for the capital intensity of investment expenditures (as indicated by the relation between net investment in durable equipment to the increment of current output) to decline when the rate of expansion of current production increases is due to the operation of the Ricardo Effect as we have interpreted it above.

However, whether the variations of capital intensity of investment expenditures is chiefly due to the operation of the Ricardo Effect or not, it is important to note that never during the period we have studied was the decline in the ratio of the net investment to the increase in inventories accompanied by an absolute decline in the net investment, or the decline in the ratio of the net investment in durable equipment to the value of the increment of current output accompanied by an absolute decline in net investment in durable equipment. This

[1] *Vide supra*, pp. 130–7.
[2] *Vide supra*, pp. 144–5.

fact does not seem to lend support to Professor Hayek's proposition that the decline in the depth of capital structure, or an increase in the eagerness of the entrepreneurs to turn over their capital more quickly, will sooner or later offset the investment demand for widening purpose and thus bring about an absolute decline in the rate of total net investment. Therefore we must conclude that Professor Hayek's theory, as it now stands, is not sufficient to explain the upper turning point of the trade cycle or the break of the boom.

As to the question what significance the decline in the capital intensity of investment expenditures, as indicated by the relation between net investment and the increment of current production, may have in the mechanism of business fluctuations, we are not ready to provide any answer at present.

Summary

In the course of this chapter, we have seen that Professor Hayek's proposition that falls in real wages during the upswing will induce reductions in the capital intensity, or the shortening of the period of turnover of investment expenditures, which will eventually become strong enough to offset the widening demand for capital investments and thus bring about a decline in the total rate of investment, is not very convincing. Our theoretical discussion points out that although we have reasons to expect that the period of turnover of investment expenditures may be reduced when the entrepreneur concerned is eager to make rapid expansion of his output, such circumstances need not coincide with a fall in product wages. Furthermore, we have pointed out that it is difficult to think that the decline in the capital intensity of investments during the upswing can offset the increase in investment expenditures which are intended to widen the capital structure and cause a downturn of the total rate of investment.

Our statistical investigation covering the rather short period of 1919–30 shows, however, that there is a certain degree of positive association between product wages and capital intensity of investment. But no definite negative correlation is observable between the latter and the profit margins in manufacturing industries, which is theoretically a more important factor than product wages. The negative correlation between the increment of current output and the capital intensity of investment expenditures, however, is quite outstanding. This appears to accord with our theoretical argument that the Ricardo Effect operates through the competition for available investible funds from the side of the demand for big additions in working capital. It cannot be ascertained, however, whether the above phenomenon is primarily the result of the operation of the Ricardo Effect, or is due merely to the fact that investments in fixed capital are largely

determined by the level of the current output rather than by the rate of its increase and that therefore an increase in the rate of increase of current output automatically leads to a reduction in the capital intensity of investments as measured by the ratio between net investments in fixed capital and the increment in current output.

One significant fact which has been brought to light is that during the period studied, the decline in the capital intensity of investment expenditures during the upswing is never associated with a decline either in total investment expenditures or in net investments in fixed capital.

STATISTICAL APPENDIX TO CHAPTER III

TABLE I (DATA FOR CHART I)

PRE-WAR MONEY AND PRODUCT WAGE-RATES, WHOLESALE PRICES, AND UNEMPLOYMENT, IN GREAT BRITAIN

Year	Index of Wage Rates (1850 = 100)	Index of Wage Rates with Trend Removed	Index of Wholesale Prices (1900 = 100)	Index of Wholesale Prices with Trend Removed	Index of Product Wage Rates	Index of Product Wage Rates with Trend Removed	Trade Union Unemployment Percentage
	I	II	III	IV	V	VI	VII
1850	100	97·6	107	93·9	93·4	99·3	
1	100	96·2	110	94·0	90·9	98·8	3·9
2	100	94·8	108	90·0	92·6	102·9	6·0
3	110	102·8	123	100·4	89·4	101·1	1·7
4	114	104·9	138	110·4	82·6	94·5	2·9
5	116	105·5	133	104·5	87·2	100·6	5·4
6	116	103·9	137	105·5	84·7	98·3	4·7
7	112	99·0	142	107·3	78·9	92·2	6·0
8	110	96·7	127	95·0	86·6	101·6	11·9
9	112	98·2	128	95·8	87·5	102·3	3·8
1860	114	99·1	132	98·3	86·4	100·9	1·9
1	114	98·2	131	97·7	87·0	100·5	5·2
2	116	98·1	135	101·2	85·9	97·0	8·4
3	117	96·9	137	102·2	85·4	95·0	6·0
4	124	101·1	140	104·0	88·6	97·1	2·7
5	126	101·3	135	100·5	93·3	100·8	2·1
6	132	104·3	136	101·4	97·1	102·8	3·3
7	131	101·6	133	99·3	98·4	102·1	7·4
8	130	98·3	132	97·9	98·5	100·3	7·9
9	130	95·8	131	96·6	99·2	99·0	6·7
1870	133	95·7	128	94·3	103·9	101·5	3·9

TABLE I (continued)

	I	II	III	IV	V	VI	VII
1871	138	97·6	133	98·7	103·8	98·9	1·6
2	146	101·5	145	108·1	100·7	93·8	0·9
3	155	106·1	147	110·3	105·4	96·0	1·2
4	156	105·3	136	103·3	114·7	101·5	1·7
5	154	102·9	128	98·6	120·3	103·4	2·4
6	152	100·9	127	99·2	119·7	101·0	3·7
7	151	100·3	125	100·5	120·8	99·8	4·7
8	148	98·8	116	96·2	127·6	103·3	6·8
9	146	98·0	111	94·4	131·5	103·2	11·4
1880	147	98·9	117	102·1	125·6	96·1	5·5
1	147	99·2	113	101·7	130·1	97·0	3·5
2	147	99·4	112	104·3	131·3	94·8	2·3
3	149	100·7	109	104·1	136·7	95·9	2·6
4	150	100·9	101	98·3	148·5	101·7	8·1
5	149	99·6	96	95·7	155·2	103·5	9·3
6	148	97·8	92	93·5	160·9	104·2	10·2
7	149	97·3	91	94·1	163·7	103·2	7·6
8	151	97·7	93	98·2	162·3	99·4	4·9
9	156	100·1	96	102·2	162·5	97·5	2·1
1890	163	103·6	96	104·1	169·8	99·4	2·1
1	163	102·6	96	105·3	169·8	97·3	3·5
2	162	101·0	91	101·0	178·0	99·6	6·3
3	162	99·9	91	102·2	178·0	97·3	7·5
4	162	99·2	84	95·7	192·8	103·2	6·9
5	162	98·6	83	95·2	195·2	103·3	5·8
6	163	98·1	81	92·4	201·2	106·0	3·3
7	166	98·8	83	94·4	200·0	104·4	3·3
8	167	98·5	85	96·6	196·5	101·7	2·8
9	172	100·6	91	102·4	189·0	98·1	2·0
1900	179	104·0	100	111·1	179·0	93·4	2·5
1	179	103·3	93	101·4	192·5	101·6	3·3
2	176	100·9	92	98·0	191·3	102·7	4·0
3	174	98·8	92	95·5	189·6	103·4	4·7
4	173	97·6	93	95·9	186·0	101·7	6·0
5	174	98·2	96	99·1	181·2	99·0	5·0
6	176	99·3	103	105·0	170·9	94·5	3·6
7	182	102·2	107	107·5	170·1	94·8	3·7
8	181	101·1	97	96·0	185·6	104·6	7·8
9	179	99·4	99	96·6	180·9	102·8	7·7
1910	179½	99·2	104	100·0	176·2	101·0	4·7

Columns I and II: Reproduced from Layton and Crowther, *Introduction to the Study of Prices*, pp. 273–4, and p. 237.

Column V: Index of money wage rates divided by index of wholesale prices and multiplied by 100.

Columns III, IV, and VI are the figures respectively of Columns I, II and V, with trend removed by nine-year moving averages.

Column VII: From Pigou, *Industrial Fluctuations*, pp. 353–4.

TABLE II (DATA FOR CHART II)

POST-WAR MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES, AND UNEMPLOYMENT, IN GREAT BRITAIN

Year	Index of Money Wage Rates (1924 = 100) I	Index of Wholesale Prices (1924 = 100) II	Index of Product Wage Rates III	Unemployment Percentage IV
1919	120·2	153·0	78·6	2·4
1920	144·0	184·9	77·9	2·4
1	143·4	118·9	120·7	14·8
2	110·7	95·5	115·9	14·3
3	99·0	95·6	103·6	11·7
4	100·0	100·0	100·0	10·3
5	100·5	95·7	105·0	11·3
6	100·5	89·1	112·8	12·5
7	100·75	85·2	118·3	9·7
8	99·75	84·4	118·2	10·8
9	99·25	82·2	120·7	10·4
1930	98·25	71·9	136·6	16·0
1	97·0	63·1	153·7	21·3
2	95·25	61·6	154·6	22·1
3	94·0	61·6	152·6	19·9
4	94·0	63·3	148·5	16·6
5	95·0	64·0	148·4	15·3
6	97·5	67·9	143·6	13·0
7	100·75	78·2	128·8	10·8
8	104·25	72·9	143·0	12·9
9	106·0	74·1	143·0	10·5

Column I: Professor Bowley's Index of Average Weekly Wages. London and Cambridge Economic Service.

Column II: Board of Trade General Index of Wholesale Prices.

Column III: Index of money wage rates divided by index of wholesale prices multiplied by 100.

Column IV: 1919 and 1920 Trade Unions Unemployment figures, from 1921 onwards Ministry of Labour figures.

TABLE III (DATA FOR CHART III)

MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES AND UNEMPLOYMENT IN THE UNITED STATES

Year	I Index of Money Wage Rates (1890–99 = 100)	II Index of Money Wage Rates with Trend Removed	III Index of Wholesale Prices (1926 = 100)	IV Index of Wholesale Prices with Trend Removed	V Index of Product Wage Rates	VI Index of Product Wage Rates with Trend Removed	VII Unemployment Percentage
1890	99	100·0	56·2	103·9	105·9	93·7	5·1
1	100	101·0	55·8	104·3	107·8	94·1	5·6
2	100	101·0	52·2	99·9	115·1	99·2	3·7
3	101	102·0	53·4	104·6	113·6	96·7	9·6
4	99	99·4	47·9	94·5	124·2	104·6	16·7
5	98	98·0	48·8	97·1	120·7	100·5	11·9
6	100	99·2	46·5	92·6	129·2	107·0	15·3
7	99	97·2	46·6	92·0	127·7	105·3	14·5
8	100	96·8	48·5	94·7	123·9	101·9	13·9
9	103	97·5	52·2	99·4	118·5	97·8	7·7
1900	107	99·1	56·1	104·4	114·7	94·6	6·3
1	110	99·6	55·3	100·1	119·6	99·3	4·5
2	114	100·4	58·9	103·5	116·3	97·0	— 0·1
3	119	101·7	59·6	101·4	120·0	100·3	— 0·2
4	120	100·0	59·7	99·3	120·8	100·7	7·1
5	122	99·3	60·1	97·9	122·0	101·4	0·7
6	127	101·2	61·8	98·0	123·5	103·1	— 1·4
7	131	102·3	65·2	102·4	120·7	99·8	0·3
8	130	99·5	62·9	98·7	122·3	100·8	12·0
9	132	99·0	67·6	102·6	117·3	96·3	5·1
1910	135	99·0	70·4	105·4	115·3	93·9	3·7
1	137	98·7	64·9	96·0	126·9	102·8	5·6
2	141	99·1	69·1	99·0	122·6	99·9	4·0
3	146	98·4	69·8	92·0	125·8	105·2	5·4
4	148	93·3	68·1	82·2	130·6	110·7	12·9

TABLE III (continued)

	I	II	III	IV	V	VI	VII
1915	149	86·3	69·5	76·8	128·9	109·5	12·4
6	163	82·7	85·5	85·2	114·5	97·4	0·7
7	184	87·3	117·5	113·4	94·1	75·6	− 3·5
8	225	99·6	131·3	123·2	103·0	79·2	− 4·1
9	261	107·0	138·6	125·8	113·2	83·2	− 0·4 (8)
1920	321	122·1	154·4	136·2	125·0	87·2	1·0(10)
1	299	106·5	97·6	84·6	184·1	121·4	27
2	284	95·5	96·7	85·3	176·5	108·0	22
3	309	99·8	100·6	91·9	184·6	105·2	11
4	319	100·1	98·1	93·6	195·5	104·8	16
5	325	101·3	103·5	105·4	188·7	96·0	14
6	333	102·4	100·0	103·2	200·1	98·9	11
7	336·7	102·4	95·4	101·1	212·2	100·3	13
8	340·8	104·9	96·7	107·1	211·8	96·7	14
9	341·1	107·1	95·3	109·8	215·1	95·9	11
1930	339·5	107·3	86·4	103·4	236·1	102·6	22
1	315·2	100·2	73·0	89·7	259·4	110·6	35
2	272·7	87·0	64·8	81·2	253·0	106·4	48
3	263·3	83·5	65·9	83·9	240·0	99·1	46
4	304·5	95·5	74·9	97·6	244·4	97·8	38
5	317·1	97·9	80·0	105·6	238·2	93·4	36
6	325·9	98·8	80·8	106·7	242·5	93·3	30
7	360·6	107·3	86·3	113·3	251·1	95·1	26
8	371·6	108·7	78·6	102·4	284·1	106·0	37

Column I: Up to 1926 this series is Professor Paul Douglas' index of hourly money wages for industry as a whole, reproduced from Douglas, *Real Wages in the United States*, p. 205. From 1926 onwards it is computed by combining Dr. Spurgeon Bell's index of average hourly earnings for manufacturing, mining, steam railroads, and construction industries, taken from S. Bell, *Productivity, Wages and National Income*, p. 21, with Department of Agriculture index of monthly wages of farm labourers (without board). These two series are weighted in approximate proportion of the wage bills in 1929 in the first four industries combined and in agriculture respectively (as given in Dr. S. Kuznets' *National Income and Capital Formation*, 1919–35, pp. 62–3).

Column III: Bureau of Labour Statistics index of wholesale prices of all commodities.

Column V: Index of money wage rates divided by index of wholesale prices and multiplied by 100.

Columns II, IV, and VI are the figures respectively of Columns I, III and V with trend eliminated by nine-year moving averages.

Column VII: Up to 1920 the figures are Professor Douglas' estimates of the percentages unemployed of his estimated normal labour supplies in industry as a whole for the different years. It is not strictly comparable with the second series from 1919 to 1938, which is Dr. Spurgeon Bell's estimates of the percentages unemployed of the number of wage-earners attached to the manufacturing, mining, railroads, and construction industries, which represent about 90 per cent of the total industrial employment. Copied from Douglas, *op. cit.*, p. 547 and S. Bell, *op. cit.*, p. 21.

TABLE IV (DATA FOR CHART IV)

MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES OF FINISHED PRODUCTS AND MAN-HOUR EMPLOYMENT IN MANUFACTURING INDUSTRIES IN THE UNITED STATES

Year	I Index of Hourly Earnings (1923–25 = 100)	II Wholesale Prices of Finished Products (1923–25 = 100)	III Index of Product Wage Rates (1919 = 100)	IV Product Wage Rates with Trend Eliminated	V Man-hour Employment (1923–25 = 100)
1919	83·5	132·3	100·0	81·0	117·2
1920	104.7	151·8	109·3	85·0	111·8
1	95·7	104·7	144·9	108·3	78·9
2	90·6	97·8	147·2	105·9	89·6
3	96·8	100·5	154·0	106·9	106·2
4	101·7	97·6	165·3	110·7	94·3
5	101·5	101·9	158·0	102·3	99·5
6	101·5	101·3	158·7	99·4	102·5
7	102·1	96·3	168·2	102·1	100·2
8	104·3	97·2	170·2	100·2	99·2
9	105·2	95·7	174·0	99·4	104·8
1930	103·9	89·2	184·6	102·4	86·0
1	96·9	78·0	196·6	106·0	69·9
2	85·7	71·2	190·7	100·1	54·7
3	84·7	71·4	187·8	96·0	59·1
4	100·8	79·2	201·5	100·3	63·9
5	104·5	83·3	198·9	96·5	70·9
6	105·7	83·1	201·6	95·5	81·0
7	118·3	88·3	212·1	98·1	86·6
8	118·8	83·3	226·2	102·1	65·5

Columns I, II, and V: Reproduced from Bell, *Productivity, Wages, and National Income*, pp. 234 and 270.

Column III: Index of hourly earnings in each year as a percentage of that of wholesale prices, converted to 1919 base.

Column IV: Figures in the previous column as percentages of the corresponding trend values on a linear trend fitted by the least square method. The equation for the trend is $y = 123{\cdot}47 + 5{\cdot}16x$, where y is the index of product wage rate and x indicates the years, with the year 1919 as the origin.

TABLE V (DATA FOR CHART V)

MONEY AND PRODUCT WAGE RATES, VALUE PER UNIT OF OUTPUT, MAN-HOUR EMPLOYMENT AND PHYSICAL VOLUME OF OUTPUT IN MINING INDUSTRIES IN THE UNITED STATES[1]

Year	I	II	III	IV	V
	Index of Hourly Earnings (1923–25 = 100)	Value per Unit of Output (1923–25 = 100)	Index of Product Wage Rates	Man-hour Employment (1923–25 = 100)	Physical Volume of Output (1923–25 = 100)
1919	77·3	110·6	69·9	108·6	76·3
1920	96·5	148·4	65·0	119·5	85·5
1	100·2	108·0	92·8	89·4	71·0
2	95·0	110·4	86·1	83·9	74·8
3	100·8	105·6	95·5	112·8	102·3
4	100·4	94·9	105·8	96·7	97·7
5	98·8	99·5	99·3	90·5	100·0
6	98·5	102·7	95·9	106·2	108·4
7	95·8	88·1	108·7	97·8	110·7
8	93·1	84·9	109·7	88·9	110·7
9	90·3	87·0	103·8	94·0	120·7
1930	87·7	79·6	110·2	83·4	106·9
1	84·2	61·1	137·8	62·1	90·8
2	75·8	59·4	127·6	46·8	74·8
3	72·4	56·8	127·5	50·2	80·9
4	89·0	69·9	127·3	54·5	87·8
5	94·6	70·6	134·0	54·4	92·9
6	98·1	78·0	125·8	60·2	105·9
7	106·2	84·8	125·2	63·2	117·0
8	108·5	81·8	132·6	49·5	99·3

Columns I, IV, and V: Reproduced from Bell, *Productivity, Wages, and National Income*, pp. 234–74.

Column II: Index of value of production at the source of production divided by index of physical volume of production, from Bell, *ibid.*, p. 274.

Column III: Column I divided by Column II multiplied by 100.

[1] The petroleum and national gas industries, as well as metal and non-metal mining industries, are included.

TABLE VI (DATA FOR CHART VI)

MONEY AND PRODUCT WAGES OF FARM LABOURERS, FARM PRICES AND FARM PRODUCTION IN THE UNITED STATES

Year	I Index of Monthly Wage Rates (1910–14 = 100)	II Prices Received by Farmers (Aug. 1909–July 1914 = 100)	III Index of Product Wage Rates	IV Index of Farm Production (1924–29 = 100)
1919	207	222	93·0	87
1920	242	218	110·9	91
1	155	123	125·5	83
2	151	132	114·4	92
3	169	142	119·0	95
4	173	143	121·0	97
5	176	156	112·8	97
6	179	145	123·4	102
7	179	139	128·8	99
8	179	149	120·1	104
9	180	146	123·3	101
1930	167	126	132·5	101
1	130	87	149·4	107
2	96	65	147·7	100
3	85	70	121·4	97
4	95	90	105·6	94
5	103	108	95·4	92
6	111	114	97·4	95
7	126	121	104·1	109
8	124	95	130·5	104
9	124	93	133·3	107

Column I: Department of Agriculture index of monthly wage rates of farm labourers (without board). From Statistical Abstract of the United States.

Column II: Index compiled by Department of Agriculture, Bureau of Agricultural Economics, from Statistical Abstract of the U.S.

Column III: Column I divided by Column II multiplied by 100.

Column IV: Index compiled by Department of Agriculture, from Statistical Abstract of the U.S.

STATISTICAL APPENDIX TO CHAPTER IV

TABLE VII (DATA FOR CHART VII)

PRODUCT WAGE RATES AND MAN-HOUR PRODUCTIVITY IN MANUFACTURING INDUSTRIES IN THE U.S.A. (1919–38)

Year	I Index of Product Wage Rates (1919 = 100)	II Trend of Product Wage Rates	III Index of Man-hour Productivity (1919 = 100)	IV Trend of Man-hour Productivity
1919	100·0	123·5	100·0	112·1
1920	109·3	128·6	110·7	117·3
1	144·9	133·8	122·3	122·5
2	147·2	138·9	135·5	127·8
3	154·0	144·1	129·9	132·9
4	165·3	149·3	139·3	138·1
5	158·0	154·4	146·4	143·2
6	158·7	159·6	148·9	148·4
7	168·2	164·8	152·6	153·6
8	170·2	169·9	166·6	158·8
9	174·0	175·1	168·4	163·9
1930	184·6	180·2	173·1	169·1
1	196·6	185·4	182·3	174·3
2	190·7	190·6	179·1	179·5
3	187·8	195·7	186·1	184·7
4	201·5	200·9	187·0	189·9
5	198·9	206·0	196·4	195·0
6	201·6	211·2	204·0	200·2
7	212·1	216·4	198·3	205·4
8	226·2	221·5	199·2	210·6

Column I: From Table IV of the Statistical Appendix to Chapter III, Column III.

Column II: Trend values of product wage rates as indicated by a linear trend fitted by means of the least square method to the index of product wages (preceding column). The equation for the trend is $y = 123{\cdot}47 + 5{\cdot}16x$, where y is the index of product wage rates and x indicates the years with 1919 as the origin.

Column III: Reproduced from Spurgeon Bell, *Productivity, Wages, and National Income*, p. 270.

Column IV: Trend values of man-hour productivity as indicated by a linear trend fitted by means of the least square method. The equation for the trend is $y = 112{\cdot}07 + 5{\cdot}19x$, where y is the index of man-hour productivity, and x indicates the years (1919 = 0).

TABLE VIII (DATA FOR CHART VIII)

PRODUCT WAGE RATES, MAN-HOUR PRODUCTIVITY, RATIO OF MONEY WAGE RATES TO RAW MATERIAL PRICES, PROFIT MARGINS, AND OUTPUT IN MANUFACTURING INDUSTRIES IN THE U.S.A. (1919–38)

Year	I Index of Output	II Product Wage Rates with Trend Removed	III Man-hour Productivity with Trend Removed	IV Profit Margins (percentages)	V Ratio of Money Wage Rates to Raw Material Prices with Trend Removed
1919	100·0	81·0	89·2	22·4	100·0
1920	105·5	85·0	94·4		114·6
1	82·3	108·3	99·8	21·9	171·6
2	103·4	105·9	106·0		142·6
3	117·6	106·9	97·7	23·2	142·1
4	112·0	110·7	100·9		144·5
5	124·2	102·3	102·2	24·2	126·8
6	130·2	99·4	100·3		130·1
7	130·4	102·1	99·3	25·3	130·6
8	140·9	100·2	104·9		125·3
9	150·6	99·4	102·7	26·7	124·1
1930	126·9	102·4	102·4		136·9
1	108·7	106·0	104·6	28·1	158·7
2	83·6	100·1	99·8		161·9
3	93·8	96·0	100·8	27·9	152·4
4	101·9	100·3	98·5		144·3
5	118·6	96·5	100·7	25·0	129·3
6	140·9	95·5	101·9		122·6
7	146·5	98·1	96·5	24·8	126·0
8	111·2	102·1	94·6		145·2

Column I: Obtained from Spurgeon Bell, *Productivity, Wages, and National Income*, p. 270, converted to the base of 1919.

Column II: From Table IV, Statistical Appendix to Chap. III, Column IV.

Column III: Index of man-hour productivity divided by the trend of man-hour productivity (Column III and Column IV of Table VII respectively) and multiplied by 100.

Column IV: Obtained from Kalecki, *Studies in Economic Dynamics*, p. 23.

Column V: Obtained by dividing the index of average hourly earnings in manufacturing industries (Column I, Table IV *supra*) with the Bureau of Labour Statistics index of wholesale prices of raw materials. The secular rising trend is removed by dividing this series with a supposed linear trend series consisting of 100, 105·2, 110·4, 115·6, . . ., the slope of this trend being deliberately taken from that of the indices of man-hour productivity and product wage rates (see Table VII, footnotes to Column II and Column IV and also *supra*, Chap. III, pp. 63–4).

STATISTICAL APPENDIX TO CHAPTER VI

TABLE IX (DATA FOR CHART IX)

HOURLY MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES OF COTTON GOODS AND OUTPUT IN COTTON TEXTILE INDUSTRY IN THE U.S.A. (1919–38)

Year	I	II	III	IV	V
	Average Hourly Earnings (1923–25 = 100)	Wholesale Prices of Cotton Goods (1923–25 = 100)	Product Wage Rates (1919 = 100)	Product Wage Rates with Trend Removed	Output (1923–25 = 100)
1919	96·7	129·5	100·0	84·1	90·8
1920	131·0	167·5	104·8	87·6	89·9
1	94·6	87·4	144·9	119·9	83·5
2	91·1	91·6	133·2	108·6	96·8
3	103·1	102·7	134·4	107·4	106·2
4	101·4	100·7	134·8	105·3	90·1
5	95·5	96·6	132·4	100·8	103·7
6	89·5	87·8	136·6	100·9	105·9
7	88·1	85·3	138·2	98·8	111·8
8	88·4	88·2	134·2	92·6	100·2
9	88·4	86·8	136·4	90·6	106·6
1930	88·7	74·4	159·5	101·9	79·2
1	76·6	58·1	176·4	108·1	78·3
2	65·3	47·4	184·4	108·2	72·3
3	75·7	62·5	162·1	91·0	90·7
4	103·3	76·0	181·9	97·6	78·0
5	102·8	73·2	188·1	96·4	81·6
6	100·6	70·5	191·2	93·5	101·7
7	112·9	74·0	204·6	95·5	107·5
8	108·2	57·4	252·6	112·4	85·2

Columns I and V: Reproduced from S. Bell, *Productivity, Wages, and National Income*, p. 307.

Column II: Bureau of Labour Statistics index of wholesale prices of cotton goods.

Column III: Index of hourly earnings in each year as a percentage of that of wholesale prices of cotton goods, converted to 1919 base.

Column IV: Figures in the preceding column as percentages of the corresponding trend values on a second degree parabolic trend fitted by the least square method. The equation for the trend is: $y = 147{\cdot}62 + 2{\cdot}79x + 0{\cdot}067x^2$, with the origin at the beginning of 1929 and x in units of six months.

TABLE X (DATA FOR CHART X)

GROSS PROFIT MARGINS, MAN-HOUR PRODUCTIVITY, AND RATIO OF MONEY WAGE RATES TO RAW COTTON PRICES IN COTTON TEXTILE INDUSTRY IN THE U.S.A. (1919–38)

Year	I Index of Man-hour Productivity	II Ratio of Average Hourly Wage Rate to Raw Cotton Prices (Index)	III Gross Profit Margins (Index)
1919	100·0	100·0	100·0
1920	105·4	131·7	—
1	97·4	219·8	82·0
2	111·7	148·3	—
3	111·8	121·1	81·2
4	112·0	121·6	—
5	113·3	138·4	71·4
6	108·1	177·7	—
7	104·7	171·9	86·8
8	112·6	152·8	—
9	117·5	159·5	85·5
1930	113·8	226·4	—
1	110·6	309·4	97·1
2	120·9	349·7	—
3	128·2	303·5	84·3
4	132·8	284·8	—
5	143·3	294·5	63·7
6	155·3	285·7	—
7	156·8	340·5	89·1
8	155·2	423·9	—

Column I: Obtained from S. Bell, *op. cit.*, p. 307, and converted to the base of 1919.

Column II: Index of average earnings in cotton textile industry (see Table IX) divided by the B.L.S. index of raw cotton prices.

Column III: Calculated from the U.S. Census of Manufactures. For method of calculation see above Chap. VI, pp. 94–5.

TABLE XI (DATA FOR CHART XI)

HOURLY MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES OF PAPER AND PULP, AND MAN-HOUR EMPLOYMENT IN PAPER AND PULP INDUSTRY IN THE U.S.A. (1919–38)

Year	I Average Hourly Earnings (1923–25 = 100)	II Wholesale Prices of Paper and Pulp (1923–25 = 100)	III Product Wage Rates (1919 = 100)	IV Product Wage Rates with Trend Removed	V Man-hour Employment (1923–25 = 100)
1919	81·8	111·9	100·0	101·1	107·7
1920	106·4	176·7	82·4	77·1	117·5
1	95·2	104·6	124·5	108·8	88·3
2	86·3	89·0	132·7	109·1	96·6
3	96·9	99·9	132·7	103·4	101·5
4	101·9	97·9	142·4	105·8	95·7
5	101·2	102·2	135·5	96·4	102·8
6	100·9	97·2	141·9	97·2	108·1
7	101·9	91·2	152·9	101·3	103·3
8	103·1	88·8	158·7	102·0	102·1
9	103·3	86·4	163·6	102·4	108·9
1930	102·9	83·7	168·2	102·8	101·6
1	101·0	79·1	174·7	104·6	81·3
2	88·3	73·4	164·5	96·8	69·5
3	83·6	74·4	153·7	89·2	77·0
4	97·2	80·4	165·5	94·8	80·3
5	99·8	77·7	175·8	99·8	86·8
6	101·4	78·4	177·1	99·8	94·3
7	114·0	89·1	175·1	98·2	100·0
8	116·8	82·6	193·5	108·3	85·9

Columns I and V: Reproduced from S. Bell, *op. cit.*, p. 302.

Column II: Bureau of Labour Statistics index of wholesale prices of paper and pulp.

Column III: Index of hourly earnings in each year as a percentage of that of wholesale prices of paper and pulp, converted to 1919 base.

Column IV: Figures in the preceding column as percentages of the corresponding trend values on a second degree parabolic trend fitted by the least square method. The equation for the trend is: $y = 157{\cdot}77 + 2{\cdot}099x + 0{\cdot}0526x^2$ with the origin at the beginning of 1929 and x in units of six months.

TABLE XII (DATA FOR CHART XII)

GROSS PROFIT MARGINS, MAN-HOUR PRODUCTIVITY, RATIO OF MONEY WAGE RATES TO PULPWOOD PRICES, AND OUTPUT IN PAPER AND PULP MANUFACTURING INDUSTRIES IN THE U.S.A. (1919–38)

Year	I Index of Man-hour Productivity	II Ratio of Average Hourly Wage Rate to Pulpwood Prices (Index)	III Gross Profit Margins (Index)	IV Index of Physical Output
1919	100·0	100·0	100·0	100·0
1920	105·3	109·0	—	114·7
1	106·2	92·4	60·3	87·0
2	124·8	103·8	—	111·8
3	133·0	116·4	85·5	125·3
4	137·4	123·6	—	121·9
5	145·2	127·4	90·3	138·4
6	148·1	131·4	—	148·5
7	156·8	140·5	104·3	150·1
8	165·0	148·2	—	156·2
9	165·6	153·8	121·0	167·5
1930	164·0	163·0	—	154·8
1	190·6	180·0	127·0	143·7
2	188·6	187·3	—	121·7
3	194·5	221·2	137·3	138·9
4	187·0	244·9	—	139·3
5	195·7	254·7	118·0	157·6
6	200·5	256·7	—	175·4
7	211·1	278·8	120·5	195·8
8	214·3	281·1	—	170·7

Column I: Obtained from Bell, *op. cit.*, p. 302, and converted to the base of 1919.

Column II: Index of average hourly earnings divided by the index of pulpwood prices computed from the average cost of pulpwood per cord (f.o.b. pulp mill), as given by the Department of Commerce, Bureau of Census, and then multiplied by 100.

Column III: Computed from the U.S. Census of Manufactures. For method of calculation see above Chap. VI, p. 101, footnote 1.

Column IV: Obtained from S. Bell, *op. cit.*, p. 302, and converted to the base of 1919.

TABLE XIII (DATA FOR CHART XIII)

HOURLY MONEY AND PRODUCT WAGE RATES, WHOLESALE PRICES OF IRON AND STEEL, AND OUTPUT IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS IN THE U.S.A. (1919–38)

Year	I	II	III	IV	V
	Average Hourly Earnings (1923–25 = 100)	Wholesale Prices of Iron and Steel (1923–25 = 100)	Product Wage Rates (1919 = 100)	Product Wage Rates with Trend Removed	Output (1923–25 = 100)
1919	84·3	118·6	100·0	99·8	83·3
1920	101·9	143·3	100·1	92·1	103·4
1	84·9	99·8	119·7	102·4	47·9
2	79·8	89·5	125·4	100·5	84·0
3	93·7	107·0	123·3	93·1	105·4
4	104·8	99·8	147·8	105·7	88·3
5	101·5	93·2	153·2	104·2	106·3
6	101·5	91·2	156·6	101·8	113·8
7	102·8	85·9	168·4	104·9	106·8
8	104·8	85·3	172·9	103·7	123·0
9	104·7	86·6	170·1	98·4	135·2
1930	107·5	81·3	186·1	104·2	99·5
1	97·6	76·0	180·7	98·1	65·0
2	94·5	72·4	183·8	97·0	35·8
3	91·1	71·7	178·7	91·9	59·1
4	108·4	79·1	192·8	96·8	66·0
5	113·9	79·1	202·5	99·4	86·7
6	115·1	79·9	202·5	97·4	120·5
7	140·3	89·6	220·4	104·1	129·2
8	143·1	90·0	223·7	103·8	71·9

Columns I and V: Reproduced from Bell, *op. cit.*, p. 299.

Column II: Bureau of Labour Statistics index of wholesale prices of iron and steel.

Column III: Index of hourly earnings in each year as a percentage of that of wholesale prices of iron and steel, converted to 1919 base.

Column IV: Figures in the preceding column as percentages of the corresponding trend values on a second degree parabolic trend fitted by the least square method. The equation for the trend is: $y = 169{\cdot}88 + 3{\cdot}033x + 0{\cdot}0334x^2$, with the origin at the beginning of 1929 and x in units of six months.

TABLE XIV (DATA FOR CHART XIV)

GROSS PROFIT MARGINS, MAN-HOUR PRODUCTIVITY, AND RATIO OF MONEY WAGE RATES TO WHOLESALE PRICES OF IRON ORES AND COKE IN BLAST FURNACES, STEEL WORKS, AND ROLLING MILLS IN THE U.S.A. (1919–38)

Year	I Index of Man-hour Productivity	II Ratio of Average Hourly Wage Rate to Prices of Iron Ores and Coke (Index)	III Gross Profit Margins (corrected for overhead labour cost)
1919	100·0	100·0	100·0
1920	127·5	91·5	—
1	116·5	99·9	73·1
2	148·7	94·3	—
3	143·7	111·1	84·0
4	145·8	142·7	—
5	165·7	151·3	98·1
6	170·6	156·2	—
7	172·7	161·2	96·6
8	194·8	166·8	—
9	196·4	159·6	120·1
1930	185·4	164·5	—
1	180·0	151·6	100·5
2	187·7	150·9	—
3	202·9	143·9	103·2
4	198·0	162·8	—
5	218·5	169·1	113·0
6	226·7	165·3	—
7	224·9	185·5	113·2
8	230·2	186·2	—

Column I: Obtained S. Bell, *op. cit.*, p. 299, and converted to the base of 1919.

Column II: The index of the prices of iron ores and coke used here as the denominator is, from 1919 to 1935, the weighted average of the prices of iron ores, coke, and steel scrap as computed by Professor F. C. Mills (see *Prices in Recession and Recovery*, Appendix V, p. 546) and is extended to 1938 by the weighted average of the Bureau of Labour Statistics price indices of iron ores and coke only.

Column III: For method of calculation and correction see above pp. 110–13.

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